The Postural Symptom-Complex

is a distinct clinical entity

THE CAUSE

The Primary Phase *One particular type of foot imbalance, inward roll of the foot and leg produces a series of related anatomical distortions which progress from below upwards and combine to produce elongating tensions which may be transmitted in varying degrees and locations to the entire central nervous system*

The Secondary Phase *After a varied time lapse long continued dysfunction due to angulation torsion and inequality of weight bearing may produce inflammation (non-infectious) of* 1 *Nerves* (Neuritis) 2 *Arteries and Veins* (Arteritis *and* Phlebitis) 3 *Muscles* (Myositis) 4 *Fascia* (Fibrositis) 5 *Ligaments* (Periarthritis) 6 *Joints* (Arthritis)

THE SYMPTOMS

The Primary Phase *General Tension produces generalized fatigue*
Local Tension produces nerve root response at single or multiple levels—with variable pressures producing different reactions

IN THIS PHASE (*Nerve tension only*) CHANGE FROM ERECT TO RECUMBENT POSITION BRINGS PROMPT RELIEF

The Secondary Phase *To the varied symptoms of nerve tension may be added those of secondary (scattered) inflammations*

IN THIS PHASE, CHANGE IN POSITION MAY OR MAY NOT BRING RELIEF (*always delayed*)

THE TREATMENT

The Primary Phase *Fixed correction (continuously maintained) blocks inward roll of the foot and leg breaks the cycle of nerve tension and relieves symptoms*

The Secondary Phase *Adjuvant therapy (of conventional types) should be added to correction to speed recovery*

Summary prepared for scientific exhibit—Fatigue and the Varied Neuralgias National Convention — American Medical Association, Chicago Illinois, 1948

THE POSTURAL COMPLEX

Observations as to Cause, Diagnosis and Treatment

By

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Every variant scientific theory must successfully
withstand the tests of time and experience

Foreword

THIS BOOK is an unique addition to the extensive literature on the relation of posture to neuralgic pain in various parts of the body As an internist especially interested in rheumatic diseases I have had to deal with many patients who would suffer as the day went on increasing fatigue and pain in the neck, shoulders, back, legs, and feet These patients would obtain more or less relief by lying down or sitting down Accordingly my attention was arrested by Dr Laurence Jones exhibits on The Postural Complex at the Conventions of the American Medical Association from 1946 to 1951 Dr Jones has been the first to recognize that the inward rotation of the foot during weight bearing is transmitted through the hip to produce a forward tilt of the pelvis This forward tilt of the pelvis in turn exaggerates the existing curves of the spine. His observation that the basic mechanical fault lies in the inward rotation of the foot led him to develop an ingenious technique for obtaining correct weight bearing This very different technique stresses rigidity

In spite of the fact I was convinced of the correctness of Dr Jones mechanical concepts I hesitated to apply them. The usual orthopedic measures had proven unsatisfactory in the severe cases so often that my patients, as well as myself were skeptical of obtaining mechanical help However in 1952 I had the opportunity to observe the author treat three cases of severe back and leg pains patients who were almost walking on their internal malleoli. The results of his treatment were astounding to me and I subsequently accepted his invitation to study his method with him.

The author describes his procedures in such detail that any interested physician can determine the corrections necessary for a patient and apply them in the proper shoes The physician will find in this method of treatment an effective solution to much of the problem of postural pain. The approach to the problem is new and much of the material has never been published The author s original ideas are at variance with much of our accepted teachings and should stimulate healthy controversy It may well be many years before we understand the mechanism that produces neuralgic pains associated with poor posture There may well be a number of different mechanisms Our situation is similar to that of the East India Company when in 1601 it required its sailing ships to carry citrus fruit to prevent scurvy among the crew

This empirical remedy was successfully used for over 300 years before scurvy was produced experimentally in animals It was another 25 years before the chemical structure of vitamin C was established Even today 22 years later we cannot say what role ascorbic acid plays at the molecular level in metabolism except in its relation to tyrosine During the interval between now and the time pain mechanisms are adequately understood, physicians who are called upon to treat pains associated with faulty body mechanics will find in this work of Dr Jones, gratifyingly effective therapeutic measures

ROBERT T POTTENGER, M.D

Pasadena California

Preface

An investigation was started 15 years ago for the sole purpose of devising better methods for the relief of localized foot pain For a long time this observer had been profoundly dissatisfied with current methods—all still in widespread use. These rely on flexible shoes with built in flexible supports, varied types of movable arch supports, and other techniques that place their sole reliance on manipulation and exercises

Since these methods based on flexibility are quite regularly ineffective, it was decided to go to the opposite extreme and stress rigidity as the major guiding principle Accordingly it was decided to use only shoes that had a considerable measure of built in stability and to fix all corrective devices immovably into these shoes

Early interest was stimulated by a completely unexpected train of events Using this different method of treatment certain patients were not only relieved of previously intractable foot pain, but at the same time the commonly associated neuralgia of low back pain, or low back pain with sciatica, was given simultaneous benefit. It was quite as difficult to give a logical reason for this connection as to explain why there were some outstanding successes and an almost equal number of failures

With the growth of clinical experience and improved methods of diagnosis and treatment, the process of postural serial distortion was recognized. Shortly thereafter the technique of plastic reenforcement slowly evolved, and with this statistical results have improved in direct proportion to the elimination of flexibility With the full realization of the gaps that still exist, many aspects of the problem have achieved sufficient clarity to permit an accounting Speculations have been reduced to a minimum consistent with proven clinical evidence, and great stress has been laid on accuracy in the reporting of results Since this is a continuing investigation, there will undoubtedly be revisions and additions

Finally it should be distinctly understood that this text is not reserved for orthopedists alone. All practitioners are equally and vitally concerned with the complex problems of the neuralgias

Laurence Jones M.D

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Acknowledgments

GRATEFUL APPRECIATION must be accorded the large number of individuals who have had a most significant part in the compilation of material. Particularly is this due the many physicians who have become interested in these problems and especially to such, in alphabetical order as M. Wesley Farr El Segundo California, P X. Krynicki, Detroit, Michigan, Royal C. Payne, Hollywood, California, Harold E Petersen, San Fernando California, and Robert T Pottenger Pasadena, California. By adopting this different approach on a considerable scale, they have established invaluable confirmation.

This text has been aided by Norman C. Lake, London, England, for permission to reproduce classical illustrations on The Evolution of the Foot, and Paul B Hoeber New York publisher for permitting reproductions from that monumental contribution, *The Brain from Ape to Man* by Frederick Tilney

Many artists have contributed to the significant medical illustrations that are such a major part of the text. Particular recognition is made to the earlier participants, such as Angela C. Bartenbeck, Chicago Illinois, and Woodrow Wilson, Jr Denver Colorado Virginia M. Sewell, of Los Angeles, California, in her first stint as a medical artist, has performed brilliantly during the past two years to prepare the greater number of figures Wilfred M. Haflinger, staff photographer for the Elmer Belt Urological Group of Los Angeles is responsible for all clinical photographs His special technique for photographic reproduction of radiographs is of exceptional character

The arduous task of preliminary edition was supplied by Nondas Slocum for several years A special commendation must be awarded Lillian Dean Long Beach, California, an author in her own right, who, fortunately for me, acquired a personal interest in this problem. Her persistent energy over the past two years provided enough irresistible force to not only counteract the almost immovable procrastination of this writer but provided an additional amount needed to transform a great accumulation of material into a concise monograph.

Finally the writer has been gratified by the long time personal interest in this problem of Charles C Thomas Publisher If the reader should consider this to be an arresting presentation, then his organization should be accorded a full measure of credit

L. J

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THE POSTURAL COMPLEX

PART I

OBSERVATIONS ON POSTURAL CHANGE AND EVOLUTIONARY ADAPTATIONS

CHAPTER ONE

The General Evolutionary Progression

n a decade it has gradually become
postural imbalance has assumed a
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accompanying panoramic figure has
(Figure 1) Only salient points have
been included representing concepts in general
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substantial sands of Darwinian theory as on
solid rocks of modern geological science.

While many ancient skeptics have questioned
time element in the varied religious accounts
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past was given a strong impetus by Hutton [1] in
oftquoted statement made just before the begin
of the Nineteenth Century that he saw no sig
a beginning, no prospect of an end. This co
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(1799) and later a brief but epochal monogra
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English Geology it would be more fitting to
sider him as the Founder of Modern Geology
a classical work he demonstrated conclusively
the earth s surface was composed of successive la
or strata, each containing imbedded fossil rem
as individualized as finger prints Since then
numerable confirmatory observations have veri
these characteristic differences that identify
layer The deeper layers contain the earlier sim
forms while each of the superimposed succee
layers contain related ones that gradually bec
more complex. On this fundamental observatio
based our present ideas of the general evolutio
progression (*superposition*)

The demonstration of the geological layers gr
ally lengthened variable conjectures as to the t
elements of Creation. Final conclusive proof c
at the beginning of the Twentieth Century—
Atomic Age—with the discovery of radium
radio-activity from the varied researches of Ro

Hutton, James *Theory of the Earth.* London, 1788

Smith, William *Order of the St ata and Their Imbe
O ganic Remains* London, 1815

Cenozoic (Modern)

Birds

Modern man

Neanderthal man

Ape man

Mammals

Chimpanzee

Gorilla

Reptiles

Paleozoic

Figure 1 The Evolution of Human Posture.

A summary based entirely on geologic (stratigraphic) evidence. In the center the line of the human succession. The lower portion from the unicellular example through the lung fish, amphibian and transitional reptiles, to the tiny tree shrew at the base of the tree trunk is a general pre-mammalian one. The center line above through the lemur and tarsier and the subsequent division is entirely primate. Other radiating lines from the tree shrew demonstrate the extreme diversity of mammalian development.

gen, Becquerel the Curies and Rutherford It was found that uranium ore the source of radium decomposed at a constant rate into lead and helium By a mathematical formula, the exact age of any given specimen of uranium ore was then determined with great accuracy by analyzing the ratio of uranium to the disintegration products in any given specimen, namely the proportion of uranium to lead.[3]

Inspection of the square in the lower right hand corner of the accompanying figure illustrates a series of strata traversed by two upright lines having small umbrella like tops. This demonstrates pictorially the lava of volcanic intrusion penetrating pre-existing layers with a spread on the surface. This is the material that contains the time-defining uranium ore, the radio-active clock. Each of these deposits in turn, with the long lapse of time, are covered by the next succession of layers In certain areas, undisturbed by major elevations or shifts, (mountains, valleys) intrusions can be studied largely in their original state. At many points successive zones have been demonstrated to be of great depth, frequently more than 20 000 feet Analysis of this uranium content when present, gives the age of each individual layer under study and when these findings are correlated with the study of fossil remains, an extremely complex but detailed picture of evolutionary progression has finally emerged. There is general agreement that the deeper layers of the earth contain no visible remains of living creatures, but that simple one-celled and multicellular creatures leaving no imprints on the rocks, must have previously existed for long aeons of time

With this recognition of fossil remains it has become possible to divide all rocks into two great classes, the basal lifeless structures, and the later superimposed layers that contain fossil imprints These upper sedimentary strata contain the geological history of the earth and can be divided into time phases that roughly correspond with the periods of human history

The first—Paleozoic or ancient history phase—lasted approximately 250 million years and during the first and greater portion of this long period all life was entirely marine From a growing number of living creatures the only representatives at that time with a spinal column was the fish Although there is much additional evidence to confirm this starting point, by the simple process of circumstantial elimination, this representative must be considered as the progenitors of the entire vertebral series In the last portion of this period, a few hardy fish pioneers changed sufficiently to be able to breathe out of water and with further modification were able to make their first hesitant advance onto dry land Further development led to the first amphibians, and it is noteworthy that some of these early vertebrates had not only a thoroughly differentiated skeletal structure, but four extremities which approximate human form even to the possession of terminal segments with five digits each

After this beginning of life on the land, there developed a general swamp-like terrain that has become the coal strata (Figure 1) This era of equable climate from pole to pole, has been studied intensively establishing information of the transitional plant and animal life of this important point in geological time

The next great era—the Mesozoic or Middle Age of geology—lasted approximately 150 million years Whereas in the earlier Paleozoic phase there were only fish and a few amphibian vertebrates this period is characterized by the development of a great profusion of differentiated cold blooded reptilian forms Many of these became exclusively land dwellers and a certain few have been identified as the forms that preceded modern mammalia Toward the end of this period a few tiny rat-shaped mammals have been discovered. Since these are the only representatives found living at this particular period in geological time, these must again, by circumstantial elimination, be considered as the sole ancestors of the entire mammalian series Shortly after the first appearance of this new type of warm-blooded animal that had hair and nursed its young, the Cenozoic or Modern era begins

The branching lines from this small figure show a few representative examples from the multitude and demonstrate the variable development of the entire mammalian series on the land, in the sea, with a few even invading the air The line of vertebrate progression that starts with the fish in

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[3] Schuchert, Charles, and Dunbar Carl O *Outlines of Historical Geol gy* 4th ed. New York, John Wiley and Sons, Inc., Ref The Radioactive Clock, pp 20-23

the sea, proceeds on land through the lung fish, transitional amphibian and reptile to the small mammal at the base of the trunk of the tree, is a general pre mammalian one. From this point on, the main line up the trunk of the tree and its branches include only the various representatives of the primate (chief') groups and is concerned solely with comparative phases leading to human development. From below upwards there are two pre-simian representatives—the lemur on the trunk, and the tarsier in the fork of the tree From the fork the tree branches into the two great final trunks of primate development—to the right, the simian anthropoid division to the left, the representatives of primitive and modern man that probably became completely terrestrial about a million years ago

A study of the entire picture in its relation to the time element, leaves one with the inescapable conclusion that the rate of evolutionary progression is increasing at a rapidly accelerating pace. It was slow in the long ancient history phase, picked up speed in the middle ages and has become relatively kaleidoscopic in the modern era. Consequently the human of only a few thousand years hence may well consider our appearance quite as incongruous as modern man finds that of the ape-man remains from South Africa. All this serves only to throw into sharper perspective the fact that *while the earth is very old the human race is very young*

After this brief preliminary summary an attempt will be made to correlate this to certain significant points in a long series of anatomical alterations Their sum total is responsible for both the strengths and weaknesses of that unique divergent development recognized as habitually erect human posture

Chapter Two

The Differentiation of the Fore and Hind Limbs

The preceding chapter has been devoted to certain considerations concerning the general evolutionary progression. To link these with the specific extremity changes that lead to human posture is simplified if one accepts the fundamental observation of Grafton Elliott Smith,[4] "It is a fact beyond dispute that the divergent specialization of the human limbs, one pair for progression, and the other for prehension . . . has played a large part in preparing the way for the emergence of the distinctly human characteristics." This statement is confirmed in the succeeding chapter on Brain Development where it will be demonstrated that the hand cannot fully perform its functions as a brain stimulator until the foot completely liberates the hand from weight bearing duties.

Man's defects are not as usually described derived only from close simian relatives but often stem from more distant progenitors. As regards the locomotor apparatus one can divide these changes into two separate classes, the first of which can be termed premammalian, and the second as primate changes that differentiate this group from other mammals.

Returning to Figure 1 in the ancient history (Paleozoic) phase of geology it will be seen that the single vertebrate representative is the fish. Progression through the water is accomplished by the sweep of pectoral and pelvic fins that propel the body through the water in much the same fashion as oars move a boat. Since we will be continuously concerned with the direction of extremity lines of force it should be noted that here they are directed away from the body.

Toward the end of the ancient history phase there was a transition from the fins of the lung fish to the differentiated extremities of the amphibians. Although extremities replaced fins, sweeping progression continued as these were still placed at the side of the body rather than under it. It is of particular interest however, that even in these early reptilian forms skeletal structure bears a remarkable similarity to the human as regards each component part (Figure 2). The fore limbs are composed of a scapula, humerus, two bones for the forearm, and a hand like terminal segment consisting of small carpal bones and five distinct digits. Similarly, the hind limbs consist of a true pelvic girdle, the posterior portion of this including the fixed lower end of the vertebral column. The remainder of the hind limb and on each side has the following parts, a femur for the upper segment and two bones for the lower segment (tibia and fibula) to which is fixed a terminal segment which is practically a counterpart of that found in the forelimb. In these earliest specimens, and subsequently in the greater number of quadruped vertebrates, fore and hind limbs continue to have more similarities than differences.

From the great multitude of reptiles of the middle geologic ages only certain transitional types, again by circumstantial elimination, are considered as being in the line of eventual mammalian development. These (theriodont) reptiles have been selected for two reasons—jaw development, and terminal limb segments that continue to have five digits. These transitional forms have been described as "half dog and half alligator."

The shifting of fore and hind limbs from the lateral position to one that is completely beneath the body represents a considerable improvement in the mode of progression. Weight bearing lines of force are now directed toward the body as the limbs changed from "oars" to true supporting members.

[4] Smith, Grafton Elliott: *The Evolution of Man*. London, Oxford University Press, 1924, p 36.

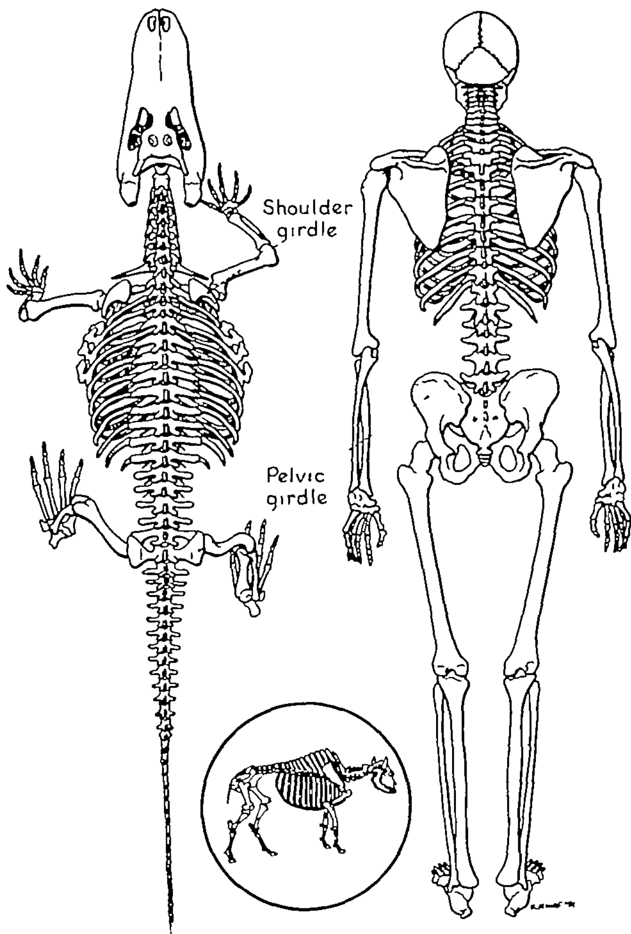
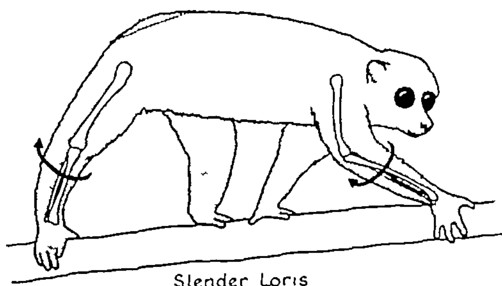


Figure The Reptilian-Human Skeletal Analogies. Quadrupedal Extremity Similarities Versus Bipedal Differentiation (Circular Insert) The skeleton of a complex modern mammalian quadruped (the bison) demonstrating that the evolutionary trend towards fore and hind limb similarity in this class not only persists but has become intensified



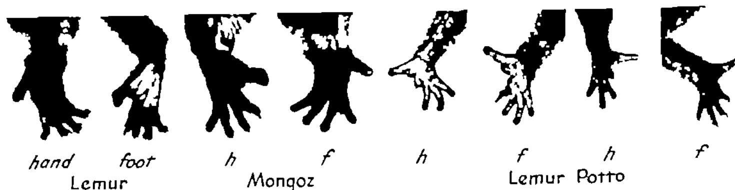


Figure 3 Complete Fore and Hind Limb Similarity in the Lemuroids. (Photographs in lower tier—Tilney F *The Brain from Ape to Man* Vol. 1 pp 30-33 Permission of Hoeber Paul B., N Y)

In the line of the human succession, there was no further change in the lines of extremity force until the appearance of the first primates

Although first found in the late Mesozoic, the first example of true warm blooded mammalian development is shown here at the base of the tree in the early Cenozoic. It is generally considered that the closest modern prototype to this tiny fellow is the tree shrew and from this small beginning arose all of the vast and varied types of the mammalian order

At the middle of the trunk of the tree and just above the tree shrew is the first representatives of early monkey like animals, termed the presimians The primate series starts at this point, the word primate being used to designate the first or highest group of animals The first of the presimians is the lemur a creeping quadruped progressing along a limb by means of a pinching grasp in all four terminal prehensile segments (Figure 3) This particular animal furnishes a logical starting point for a description of the series of extremity changes that finally lead to the present human forms In this earliest representative the almost complete similarity of fore and hind limbs continues with the addition of two new features, the appearance of grasp (prehension) in the terminal segments with function improved by rotation in the joints corresponding to the elbows and the knees There is such a striking resemblance of form and function in fore and hind limbs when the hands and feet are compared, it is difficult to tell one from the other

In the fork of the tree is found another presimian —the tarsius or tarsier (Figure 1) Differentiation between fore and hind limbs begins with this particular animal in that it occasionally uses the hind limbs for hopping progression in much the same manner as the kangaroo At other times it continues lemuroid progression of the creeping, grasping type With further development the next simian anthropoid examples, grasping creeping progression is supplanted by swinging movement using

the fore limbs only—(brachiation) In certain members of the simian tribe this has come to full flower for in these animals the fore limbs actually assume command. *In fact, so adept has this group become* in swinging from place to place by means of the fore limbs, their ordinary movements put to shame the feats of the most accomplished aerialists

As regards the fore limbs this again changes or shifts the lines of force. In this mode they become bipolar at times being directed away from the body in brachiation, at others being directed towards the body when quadruped stance is assumed The *hind* limbs do not partake in this bipolar development since they continue to be supporting members with the lines of force directed towards the body

Before attempting to describe the present human anatomical differences between upper and lower extremities preliminary attention should be directed to two particular areas the shoulder for the upper extremity the *foot for the lower Although there* are certain minor differences in human and simian shoulders comparative anatomy demonstrates conclusively that they must have had the same origin namely the arboreal one But *these* differences, although slight, furnish certain clues as to the undeniable superiority of simian anthropoid functional performance. It is quite possible that the functional stimulus toward evolutionary improvement of the human shoulder joint was diminished when man left the trees somewhat less than a million years ago During the same period the simians continued to improve fore limb function by their continued residence in the branches

In the human the hind limbs were forced to assume more and more the duties of full weight bearing resulting in the present comparatively advanced development of the lower extremity and the human foot Actually from this same standpoint of comparative anatomy the human lower extremity differs far more than does the upper extremity when these limbs are compared with similar structures in his nearby co-ördinates (Figure 1) Let us complete this comparative study by noting outstanding differences of human form and function now present in the shoulder of the upper and the foot of the lower extremities

In an article, attention has previously been called to certain changes in concept of shoulder function only slightly modified by ten years of added clinical experience[5] The shoulder girdle consists of the scapula and the clavicle linked together by a series *of ligaments at the acromioclavicular joint,* and attached to the body in front only at the sternoclavicular junction All of its attachments to the costal cage are therefore muscular with this one exception. *Attached to this structure at the glenoid is the* upper extremity The sternal link is a freely movable joint, and the net result is that in certain movements the shoulder girdle seems to float in the air But hundreds *of pounds of weight cannot be lifted on a* shoulder girdle that floats in the air" It must be fixed and stable As its only significant connections to the costal cage are muscular then stabilization *must occur through muscular action.*

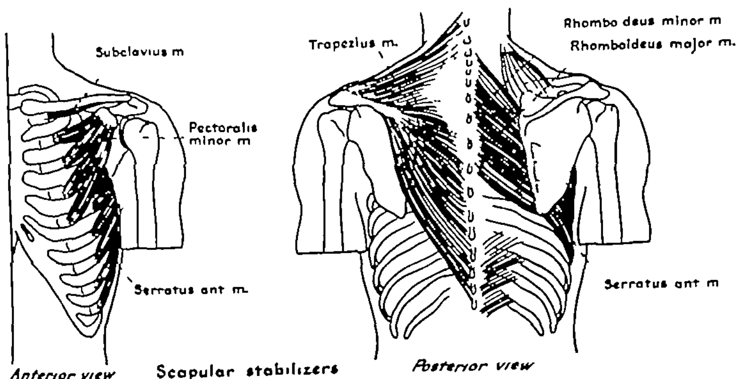
The effort stimulus presents many gradations and combinations If effort demands that this joint be stabilized, rendered immobile, then simultaneously *the glenoid and the head of the humerus must be* fixed Just as it takes two parties to make a contract, so does it take two joint surfaces to make a joint. One is the glenoid, which belongs to the scapula, and *the other is the articular surface of the head of the* humerus. Thus, two distinct muscle systems must be involved, those connecting the scapula to the costal cage, and those connecting the head of the humerus *to the scapula. Let us attempt to explain the first* of these two complexes.

This is effected by synchronization of muscles which cause the scapula and clavicle to be pulled *firmly against the costal cage.* Once this is accomplished the glenoid becomes a fixed point. The chief muscles effecting this are the subclavius and the pectoralis minor acting as stabilizers anteriorly the trapezius, major and minor rhomboids, posteriorly and the serratus anterior which acts powerfully on the vertebral border of the scapula, although it originates anteriorly (Figure 4A) This combined mechanism resembles the guy ropes of a tent pole in that, if they act simultaneously they stabilize by counter action

The second phase of this problem is, namely stabilization of the articular surface of the head of the humerus, the outer side of the joint, by muscles

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[5] The shoulder joint — Observations on the anatomy and physiology Jones, Laurence· *Surg Gynec & Obst* 75·435-444 Oct. 1942.



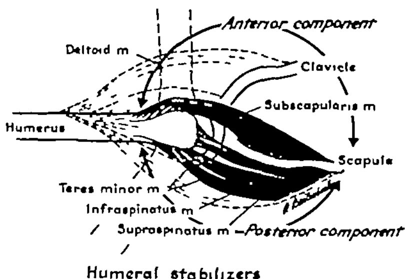
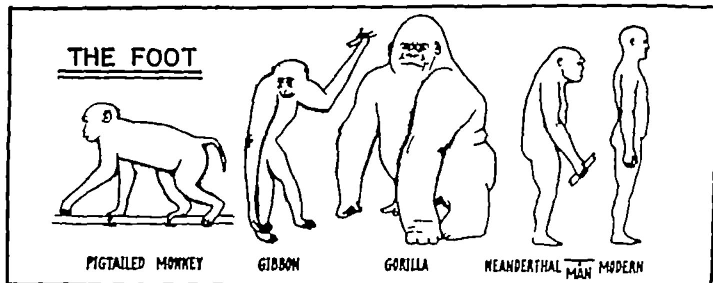
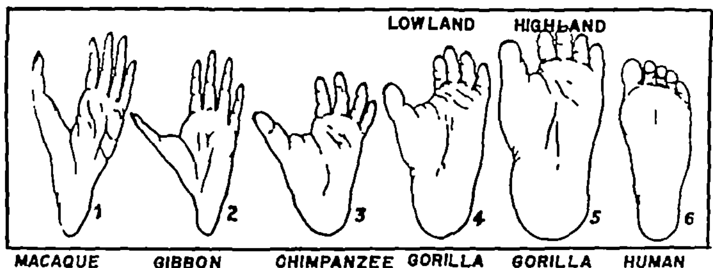


Figure 4. The Dual Mechanism of Scapulo-Humeral Stabilization. A. The scapular stabilizers. B The humeral stabilizers.

connecting the scapula and the head This is accomplished in the presence of severe mechanical disadvantage. That it can be done at all is a triumph of evolutionary adaptation. The upper end of the humerus has become a half spheroid the 'ball of what is described as a ball and socket joint.

A better description would be that it is a ball without a socket The fact is that the glenoid has become flat, deepened only by a vestigal thin layer of cartilage All of this is the interest of a completely free range of relaxed motion. But the effort syndrome calls for primary stabilization firm fixation of this rounded head in a flat glenoid, and this is accomplished by four muscles, usually described as short rotators There are actually two inner humeral components those arising from the





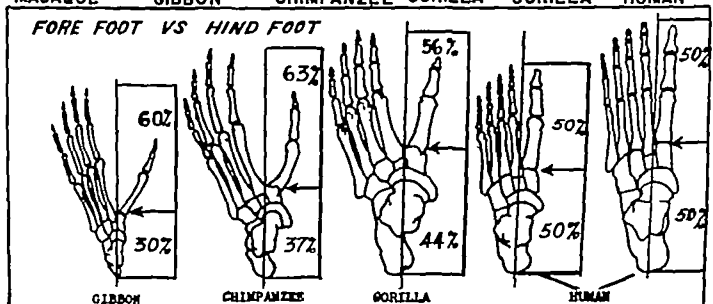


Figure 5 Evolutionary Trend to Rigidity in the Primate Foot and the Relation to Body Posture. A. Primate shifts from the quadruped to erect bipedal posture. B The gradual loss of prehension (flexibility)—The shift from large toe abduction—The decrease of digit length C The skeletal shifts with increase of tarsal ratio—The incorporation of the metatarsals into the rigid arch structure (Permission, Lake, Norman C. *The Foot* Figures 13-14 15 Williams & Wilkins, Baltimore, Md.)

front of the scapula—the subscapularis—and the remainder from the posterior surface—the combined supraspinatus and infraspinatus—teres minor (Figure 4B) The dual mechanism of scapulohumeral movement permits an almost universal range of motion in all planes with bipolar lines of force

Just as every change in the upper extremity would seem to be designed to improve hand function, so every evolutionary change in the lower extremity is in the direction of improving the function of its terminal segment, the foot A series of pictures rearranged from Lake illustrate the significant relationship of foot development to the acquisition of habitual erect posture (Figure 5 A, B and C)

This series starts with the simian group and again illustrates the similarity of hands and feet in the early representatives of the primate series As the scale progresses through the preanthropoids (Gibbon) to the anthropoid representatives, (chimpazee and two types of gorillas) it appears that with increasing use of the lower extremities for weight bearing there is a progressive and marked series of shifts from the hand like similarity of the foot toward its eventual human form. Progressively the large toe loses its abducted thumb-like angulation to drift toward the present straight line position with its long axis parallel to the shafts of the remaining metatarsi Of particular interest, as pointed out by Schultz,[4] is the difference that exists between two closely related gorillas who have a noticeable difference in their respective large toe alignments When the proportional bone structure of this series of feet is analyzed, it is found that the toes progressively decrease in size losing their finger like characteristics and, at the same time, the proportionate size of the heel and other tarsal bones increases markedly when their combined length is compared to the overall length of the foot Not until the tarsal length becomes 50% of the total measurement does there occur the development of the rigid human long arch (Figure 5C) Since the maintenance of flexibility of the foot has been stressed so heavily in the past, it might be well to confirm the observations of Lake and others that in the human foot the trend is steadily away from flexibility The orthopedic and pediatric exponents of flexibility should recognize that, in no single instance do the flexible or semi flexible feet of the simian-anthropoid group permit sustained completely erect posture

In the composite illustrations of Figure 6 are demonstrated the essential differences that have developed in upper and lower extremity form and function The dual mechanism of scapulo-humeral controls have been discussed and illustrated There is a distinct and different synchronization at this one point in which the scapula follows humeral movement after the 45 abductive angle is attained in the ratio of one to three. As regards the remainder of the arm, the elbow joint or junction of the arm and forearm is almost a pure hinge-type joint. This movement is considerably altered however by the radial articulation to the ulna, relatively unchanged from the early fore limb of the presimian lemur (Figure 1) This permits the radius to rotate around the ulna and this turning of the forearm permits the movements of pronation and supination To favor continuing prehensility of the hand, wrist joint mobility is enhanced by two rows of small carpal bones The fingers are completely prehensile. They not only can be opened and shut as a grasping unit, but the thumb is placed at a wide angle from the remaining fingers so that it can be opposed to each finger for purposes of fine movement. In short, the entire upper extremity has become a working unit with a free universal range of motion designed to improve the function of its terminal segment, the hand. A summary and postulate governing this particular and different physiology of movement will be summarized at the conclusion of this chapter

The component parts of the lower extremities will be analyzed to complete the comparative study Instead of the movable shoulder girdle free of bony connections, the lower extremity is firmly attached to the rigid pelvic girdle. Whereas the shoulder girdle is a misnomer in the human as the scapulae are not linked together as in birds, the two pelvic bones form an almost immovable unit, not only linked to each other in front, but to the sacrum behind. Such sharply limited motion as remains actually occurs more from the movement of adjoining neighboring structures rather than from the component parts of the pelvis *per se* The long funnel

Schultz, A. H. Some distinguishing characteristics of the mountain gorilla. *J Mammal* 1 31 1934

TABLE OF RELATIVE MOVEMENT
FOR SYNCHRONIZED SCAPULO-HUMERAL POSITIONS

X RAY POSITION	HUMERAL ANGLE	SCAPULAR ANGLE (VERTEBRAL BORDER)
1	10	10
2	45°	10°
3	90	25
4	75°	50°

COMPARATIVE SCAPULAR RANGE & HUMERAL RANGE

HABITUAL LINE OF FORCE

LEFT SUPINATION

LEFT PRONATION

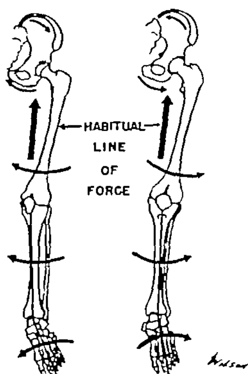


Figure 6. Physiological Differences of Extremity Movement. A Segmental independence of movement in the non-weight bearing upper extremity B Segmental synchronization of movement in the weight bearing lower extremity

shape of previous types has adapted itself to habitual upright posture by becoming a shallow and widened basin Movement is sharply restricted in the hip joint when this is compared to the shoulder Instead of the flat glenoid there is a cup-shaped acetabulum which snugly fits the rounded head of the femur to greatly improve the stability demanded by unilateral weight bearing

Rotation in the leg or lower portions of the extremity as found originally in the presimian lemur and still present in the forearm of the human, has completely disappeared in the leg The knee is a perfect hinge joint permitting only forward and backward motion without this being altered by rotatory movements of the tibia on the fibula. In fact, these two bones (tibia and fibula) are linked to each other so tightly above and below as to become functionally a single bone The lower end of these two tightly conjoined bones unite to form the ankle mortice designed to snugly fit the uppermost of the tarsal bones the talus Here again, just as in the knee joint, is a pure hinged type joint permitting forward and backward movement, with little or no lateral movement at this precise point. Beneath the talus lies the calcaneus or heel bone, and here is the only point in the lower extremity in which, during weight bearing, there is a small but completely synchronized lateral movement. Even here, lateral movement has become severely restricted.

The foot has evolved into a rigid organ with the tarsal bones fused to the metatarsals to form a rigid long arch, *a unitary structure designed to bear the entire body weight with the complete bipedal alternation of gait* Whereas the upper extremity has directed all evolutionary changes toward the maintenance of flexibility the lower extremity has steadily developed towards an increased rigidity in all segments, as the evolutionary response to unilateral independent weight bearing

Self imposed experiments will conclusively demonstrate these differences One can demonstrate by one's own movements that the hand forearm, arm, and shoulder can be placed in an infinitely varied number of positions, as regards each individual joint, without the movement of one causing a change of position in the adjoining structures Continuing self-experiment, in the standing position inspect the bared foot and leg to a point above the knee joint. First roll the foot toward its inner border and then toward its outer border Note that with the slightest rotatory movement of the foot in either inward or outward direction there is an exactly comparable and corresponding movement in the entire remaining segments of the lower extremity from the ankle to the hip joint

These differences in the physiology of upper and lower extremity movement are illustrated in the combined illustrations of Figure 6 When the two extremities are compared in this way the tremendous differences wrought by evolutionary adaptation become evident.

In the upper extremity below the shoulder joint, optimum functional performance, freed from the duties of weight bearing, demands a complete segmental independence of movement, viz., *movement in one segment is not transmitted to others* In the lower extremity complete segmental synchronization of the component parts is a prime requisite to the primary function of independent unilateral weight bearing, viz., *rotatory movement of any one segment in the standing or weight bearing position is immediately and equally transmitted to the entire structure*

CHAPTER THREE

Brain Development

THE DEVELOPMENT of basic differences in the extremities were accompanied by a comparable series of changes in the central nervous system and the vertebral column. In fact, the theory was first propounded by Smith,[4] and later confirmed by Tilney[7] that the improved type of primate brain was largely dependent on the information obtained by the prehensile hand. When the hand is completely freed from the duties of weight bearing by the development of a suitable (human) foot, the brain achieves the advanced development of the human type.

The human brain is not only the finest product, but the supreme achievement of comparative evolution. It is this organ that enables us not only to communicate concrete and abstract ideas but to translate these ideas into skilled acts. This alone immediately places the human race in a distinct category separating it from other living creatures by a chasm as wide as the Grand Canyon. To control adequately the great differences of function in upper and lower extremities there must be developed an extremely improved and infinitely more complex brain. If examples of brain development in general are studied from the simplest to the more complex types it will be found that in all living things differences in body function determine not only the internal structure but the gross shape of the brain as well.

A composite picture has been assembled and rearranged from Tilney showing examples of these changes in external form (Figure 7). In the upper line is the automatic mid brain of the fish, almost without higher centers. In the second line are representatives of amphibian, reptilian, and bird brains which show the beginning development of the higher centers (cerebrum and cerebellum). In the third row are the varied mammalian brains that illustrate adequately that difference of function results in a concomitant change of form.

Returning to the base of the tree in the first figure, one will find the varied representatives of the primate succession (the presimian, the simian anthropoid, and human series) have one thing in common, prehensile terminal segments for their fore and hind limbs. It would seem, therefore, that their common ability to grasp objects, even in the earliest presimians (lemur and tarsier) determines the distinctive primate shape of the brain. This particular point, namely the relation of primate posture and function to brain development has been covered in an incomparable manner in the comparative pictures and explanatory captions from the classical work of Tilney (Figure 8).

Smith, Grafton Elliott. *The Evolution of Man*. London.

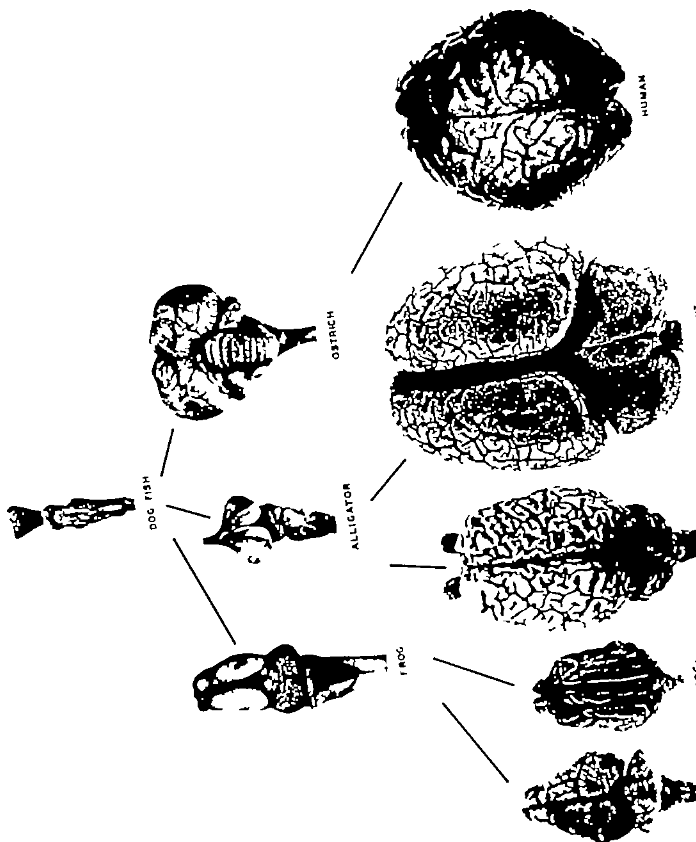
Sir Grafton Elliott Smith, M.A., M.D. F.R.S. 1871-1937 is unquestionably the greatest figure in the study of comparative evolution of the brain. Over a period of 40 years he wrote a great number of classical articles on various aspects of this subject and one small volume designed for popular consumption, namely *The Evolution of Man*. He was the first to coin the term neopallium (new cloak) to describe the gradual development of the cerebrum as a cover for the naked mid-brain of the lower vertebrates.

Tilney, Frederick. *The Brain from Ape to Man*. 2 vols. New York, Hoeber.

Frederick Tilney was a long time professor of neurology, Columbia University. While he was an independent investigator and a contempory of Smith, clear priority should be accorded Smith for first formulating this particular concept of evolutionary progression. Tilney's encyclopedic two volume work, *The Brain from Ape to Man* confirms the earlier observations of Smith, and far surpasses Smith's descriptions in both clarity and form. In fact, this work is a major, if somewhat neglected scientific literary accomplishment.

To add a personal comment of interest the writer, while a student at the College of Physicians and Surgeons, Columbia University, was privileged to attend lectures of the late professor Tilney. Although he must have been preoccupied with the problems of comparative anatomy at that time it cannot be recalled that he ever mentioned them in his many lectures.

BRAIN DEVELOPMENT



There is every reason to accept, almost in its entirety the Smith-Tilney hypothesis, namely that progressive evolutionary changes in the brain are directly dependent or interdependent on improvements that occur in primate posture With humanoid erect posture comes the present advanced development. Unquestionably the brain has served as the governor (steering mechanism) largely responsible for our present position Chapters that precede and follow will point out however that in many areas the *excessive cerebral demands on function have out stripped the organic changes wrought by progressive evolutionary adaptation*

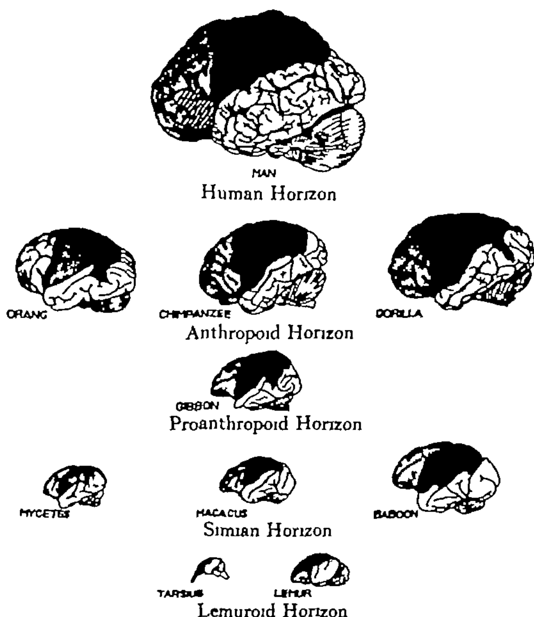


Figure 8 A Comparative Study of Primate Posture and Cerebral Expansion. (Tilney F *The Brain from Ape to Man*, Vol. 2, Figure 459 pp 988 989 Permission of Hoeber Paul B., N Y)

In this figure each brain is reduced to two-sevenths actual size. The progressive expansion of the psychic area (blue) is clearly demonstrated in ascending from tarsius to man (Tilney) Key Blue, Psychic Region Red, Motor Region Green, Sensory Region Yellow Visual Region Gray Auditory Region Red and Blue (striped) Speech Area.

Explanatory Note to Figure 8 (Tilney)

Illustrations and matching captions should read from below upwards

"The several horizons of cerebral development indicated by the figures on the opposite page requires some further comment with reference to their evolutional significance.

V The Human Horizon demonstrates certain anthropomorphous conclusions which were first suggested in the proanthropoid stage Effectual erect posture is at length attained, the hands liberated from purposes of locomotion, speech acquired, *and the frontal area of the brain greatly expanded.* The primate tendency so obviously introduced on the Lemuroid Horizon has, under the influence of arborealization, progressed to a proanthropoid stage whose essential contribution is the inception of the erect posture. Two major lines of anthropoid derivation induced the adaptations which led respectively on the one hand to the great apes and on the other to man. Whether the anthropoid stem was a separate offshoot from the proanthropoid level, or whether several such offshoots developed, is still a question. The morphological constituents of the brain strongly suggest that the departure of man from the proanthropoid level was at first by a stem in common with Chimpanzee and Gorilla, with subsequent bifurcation leading to the wide divergence between the human and his neighboring coordinates among the great apes.

IV The Anthropoid Horizon shows a further specialization in the direction of the ultimate erect posture of man and the final freeing of the hands for purposes other than those of locomotion. Arborealization still exerts such a potent influence upon all of the three great apes, that their advances in the direction of anthropoid specialization are definitely restrained by this factor While all of the three great apes Orang-Outang, Chimpanzee and Gorilla, habitually walk in a modified pronograde manner using the knuckles of the extended hand for support in walking and running, these animals are capable of standing, walking and running upright. The erect posture, under these circumstances, has little of the perfection attained by man. It is both ineffectual and ungainly Running and walking are done with a shuffling, waddling gait, with a tendency to come down upon all fours whenever speed is necessary The great weight of the anthropoid apes has enforced upon them an arboreo-terrestrial mode of life. This is more particularly true of the Gorilla which, although it does not resort to anything approaching brachiation in its arboreal locomotion, does employ its massive arms for reaching up to the branches, thus drawing itself upward from the ground. All three of the great apes appear to be offshoots from the proanthropoid stem while still another offshoot gave rise to the races of men.

III. The Proanthropoid Horizon is epochal in its effects. A new type of adaptation has reorganized the proportions and postures of the entire body Brachiation is now substituted for a pronograde locomotion in which latter the upper *surfaces of the branches are grasped by the handlike fore and hind extremities.* Swinging from the branches, as do the Gibbons, has produced a marked elongation of the hands, arms and trunk. It has further caused the body to assume a more perpendicular position in passing through the trees and a real erect posture upon the ground. The Gibbon can in fact stand, walk and run upright. It has, in addition, lost its tail, due undoubtedly to its well-established habit of sitting upright in true anthropoid fashion. The animal is, nevertheless, much inferior in its cerebral organization to the higher anthropoid apes and is hence regarded as a representative of that proanthropoid stage whose arboreal readjustments laid the foundations for the development of the great apes and man.

II. The Simian Horizon illustrates the definite crystallization in cerebral architecture of *those structural features* which result from the adaptations to arboreal habitat. It clearly reflects the attainment of quadrumanous specialization, at the same time disclosing the effects of certain restrictive influences, such as pronograde locomotion and the as yet partial liberation of the forelimbs from locomotory function. (Old and New World Monkeys.)

I. The Lemuroid Horizon is here considered the basic primate level. It contains many brain features, still in the crude, which become dominant in later development. It also illustrates such hesitations and indecisions as might be inherent in a momentous transitional stage. Faintly at least, it shows the first feeble impressions imparted to the brain by adaptation to arboreal life and indicates the general lines of cerebral advance consequent upon tree-living habits." (Tarsius and Lemur)

CHAPTER FOUR

The Spinal Column and Cord—The Container and Contents

IF A POLL was taken as to the point of greatest weakness in the human anatomy the low back region would be selected by an overwhelming majority This choice would be dictated by the fact that a high percentage of the entire adult population is suffering from acute or chronic low back pain But if individuals were asked the reason for this there would be great diversity of opinion.

It is generally recognized that the change from the quadrupedal stance to the bipedal one entailed a shift of the vertebral column from the horizontal to a vertical one The resultant structural deficiencies are not explained by simply stating that the human vertebral column is a quadruped one turned upright on its base. While correct as far as it goes, this fails to take into account certain specific defects that arise from the upright position. Nor is it enough to compare the human trunk to a tent that has its supporting unit placed far behind the mechanically correct centered position. It is true all weight is suspended on the front, counterbalanced only by a thin posterior sheet of muscular and ligamentous structures, but this does not in itself explain the cause of low back pain and the other varied neuralgias

There is an almost complete lack of information in literature concerning the comparative anatomy of spinal cord lengths. This does not apply to studies made on the bony vertebral structure Laboring under the impression that this particular additional information could be supplied by two of the most prominent investigators in this area, personal communications were addressed to Sir Arthur Keith, Kent, England, and Professor A. H Schulz, The Johns Hopkins University Both afforded me the courtesy of replies, but were unable to give the specific information requested

Although unable to trace comparative primate disparity there is a wealth of information on the relative shortness of the human spinal cord in its relation to the vertebral column. Reimann and Johnson[1] individually report measurements on 129 adult specimens At the same time they reviewed previous studies made by in the order of their appearance, A. Thompson, 198 R. E McCotter 234 and G H Needles, 240 totalling the considerable number of 801

In a three months fetus the spinal cord is approximately the same length as the vertebral column. That this shortening begins in intra-uterine life is demonstrated in Figure 9 *From this point of equal length until full growth is attained the vertebral column increases 22 times in total length while the spinal cord increases only 12 times*

The generally accepted level of termination has been fixed at the junction of the first and second lumbar vertebrae. Although it had been accepted that there must be considerable individual variation, the range was wider than had been anticipated, varying from the middle of the twelfth thoracic to the lower third of the third lumbar Only 51% are found in the zone between the junction of the middle and lower thirds of the first lumbar the intervertebral disc, and the junctions of the upper and middle thirds of the second lumbar Particular attention is called to a most significant finding that approximately 15% are quite short, ending at points above or even with the line marking the junction of the upper and middle thirds of the first lumbar vertebral body Five percent of this number are so short as to terminate at or above the level of the lower margin of the twelfth thoracic body

[1] Reimann, Arthur F and Johnson, Barry Vertebral level of the termination of the spinal cord. *Anat Rec* 88 127 1944.



Figure 9 Five Month Premature Fetus with Brain and Spinal Cord Exposed. A. Lateral view—Early change from primary vertebral convexity B. Posterior view—Early retraction of spinal cord to level of lumbosacral junction (pin) (Permission of Woerdemann, M. W., Anatomical Museum, University of Amsterdam.)

There is a tendency for the spinal cord to be slightly longer in females and in Negroes than in white males No definite correlation was found to exist between the height of the body or the length of the vertebral column, or between either of these and the relative length of the spinal cord.

It has just been noted that the vertebral column and spinal cord are approximately the same length in the three month fetus In an attempt to determine the exact time at which spinal cord shortening begins in prenatal life, an unusual specimen was located in the Anatomical Museum, University of Amsterdam, Holland A photograph of this five month premature fetus is reproduced (Figure 9) The brain and spinal cord had been laboriously exposed and dissected Although the vertebral column is only beginning to straighten from its position of extreme primary convexity the spinal cord has already retracted from its original over all length, and now the lower end lies at the level of the lumbosacral junction

Further illumination is obtained on these vital points in the recently published Atlas of Dr Woerdemann [9] Here, a dissection of the spinal cord of a fourteen month old child reveals that at this stage it has already shortened to terminate at a point only slightly lower than the final average adult position, viz., near the interspace between the first and second lumbar vertebrae (Figure 10B) Even at this early point, the spinal cord has become relatively much shorter as evidenced by the long cauda equina needed to fill the defect.

But Woerdemann's figures demonstrate that in

[9] Woerdemann, M W., *Atlas of Human Anatomy* Vol 2, Figures 392 393 Philadelphia, Toronto Blakiston, 1950

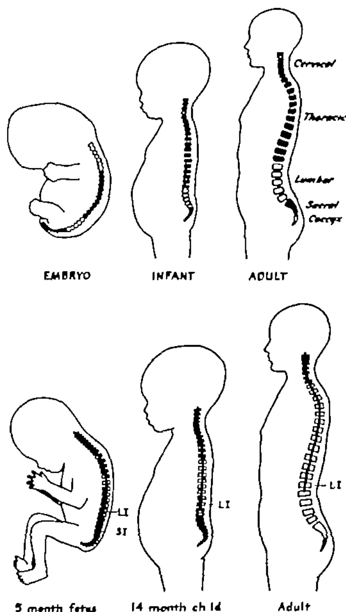


Figure 10. The Spinal Disparity A (*Upper*) Spinal contour at different age levels. B (*Lower*) The Relative Shortness of the spinal cord at three different age periods.

the dissection of the adult vertebral column, although the spinal cord still ends at approximately the same point, the cauda equina has become comparatively even longer This series of observations can only mean that, as has been mentioned, from top to bottom the vertebral column grows at a much faster rate than does the spinal cord, and this disproportion increases more in the lower segments than in the upper ones An inspection of (Figure 11) will show that even in the cervical region each nerve root must angulate downward slightly at first, to reach its respective opening or foramen. Proceeding from above downward, this differential increases rapidly with each vertebral segment until at the bottom, the difference is so great that the lowest segmental group the lumbar sacral, and single coccygeal nerves remain within the spinal canal for long distances before they can reach their final forminal point of emergence.

The final increased disproportion is in all probability aggravated by the development of adult human spinal curves (Figure 10 A and B) and the marked comparative increased length of the human lower extremities (Figure 1)

In summation, there is nothing more certain than that humanoid erect posture has resulted in a considerable disproportion between the container the spinal column, and its contents, the spinal cord. This difference, in combination with other points of instability arising from bipedal erect stance and gait, would seem to account for the almost universal human predisposition to neuralgias at single or multiple levels As a direct outgrowth of this it will be propounded that to latent tension, postural deviation will add increased tightness that may affect part or all of the entire central nervous system. It may well be that the 15% having cords shorter than the normal variation may be the very cases that are refractory to treatment of any kind

Since the component parts of the central nervous system are a continuous structure it will be demonstrated that physical tension arising in one part must be transmitted in variable degrees to nearby and distant areas

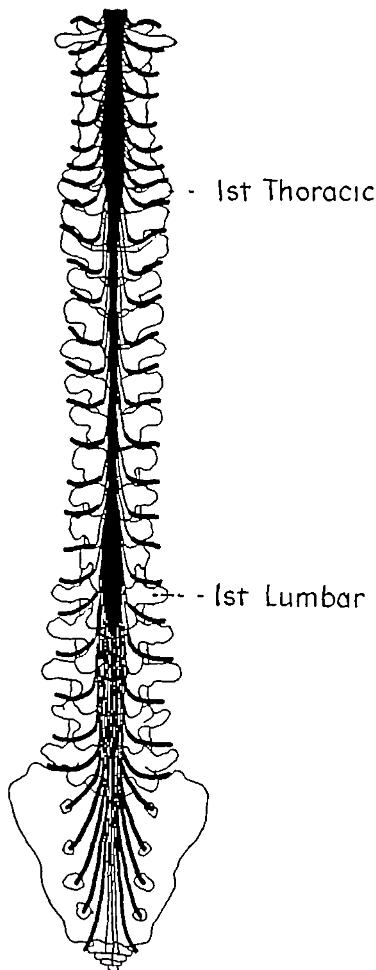


Figure 11 The Disproportionate Length and Width of the Spinal Cord in the Spinal Canal—The Progressive Nerve Root Angulation from Above Downward.

PART II

CAUSES AND MECHANISMS

CHAPTER FIVE

The Postural Complex-General Considerations

E PRECEDING CHAPTERS have been devoted to a y of a variety of preliminary salient consid ions largely concerned with the evolutionary iges that lead to humanoid posture The postural alance arising from the structural weaknesses of mplete adaptation is a major cause of a definite widening pattern of symptoms that will be ned the Postural Complex. This hypothesis has n given confirmation by the simple fact that rection of these deviations regularly brings ap- ciable benefit. The titles of successive scientific ubits, from 1946 to 1951 illustrate this gradual lening of horizons * As a necessary preliminary asure, there will be described the serial anatomical nges that produce symptoms and those that sub- ntially modify them.

The accompanying diagramatic presentation con s of two central figures surrounded by two large centric circles (Figure 12) The concepts on ich they are based have been completely un inged since these composite pictures were pre- ted for the Chicago exhibit of 1948 It should noted that each circle, both inner and outer con tutes a distinct but related unit. Together they rm a study in serial shifts whereby the change in sition at the bottom of each is communicated to e varied parts of the immediate and distant super ructure. The 10 figures to the left are accompanied 10 matching captions on the right. In the center e two skeletal figures that summarize the series of anges depicted in the two concentric circles— erve Tension, for the inner series—Nerve Release, r the *outer*

The bottom figure of the inner circle of serial distortion demonstrates the extremely important *synchronized rotation of the foot and leg* (*the trig ger mechanism*) This mechanism of angulation pressure will be analyzed later in considerable de- tail

Inner circle (2) represents this unitary shift of the vertical segment of the lower extremity (leg and thigh) as exemplified by patellar and knee joint movement

Inner circles (3-4 5) can be designated as the pelvic triad demonstrating that this synchronized movement of the entire lower extremity—transverse segment (foot) and the vertical segment (leg and thigh) are communicated in measurable degree to the pelvis Circle (3) concerns the mechanism of pelvic angulation and is of such importance that it merits detailed analysis Evidence will be presented that will correlate the fact that synchronized rotatory movements of the foot and leg cause corresponding changes in the pelvis the spinal column and its con tents the spinal cord It should be noted that the pelvis is mounted centrally on the hip joints When the mode of suspension is considered movement of the pelvis must be of a type corresponding to that of a wheel mounted on an axle When the top moves forward, the base must move backward in exactly the same arc and degree of movement. Incorporated in this figure is an important factor viz., the attach ment of the iliacus muscle to the internal and anterior surface of the iliac wing The widespread fan like muscular fibres of origin unite into a nar row tendon which passes over the anterior surface of the pubis just lateral to the symphysis and then angulates sharply to finally insert into the inner upper surface of the femur at the projecting inner trochanter Through this medium strong internal rotation of the upper end of the femur would pull directly on the upper surface of the pelvis the force

* Jones, Laurence Scientific Exhibits, National Conventions the American Medical Association Sciatica and Low Back ain, San Francisco California, 1946. Fatigue and the Varied euralgias, Chicago Illinois, 1948 Nerve Tension and Inflam- ation, Atlantic City 1949 Los Angeles California, 1951

INNER CIRCLE

THE CYCLE OF SERIAL DISTORTION
AND
NERVE TENSION

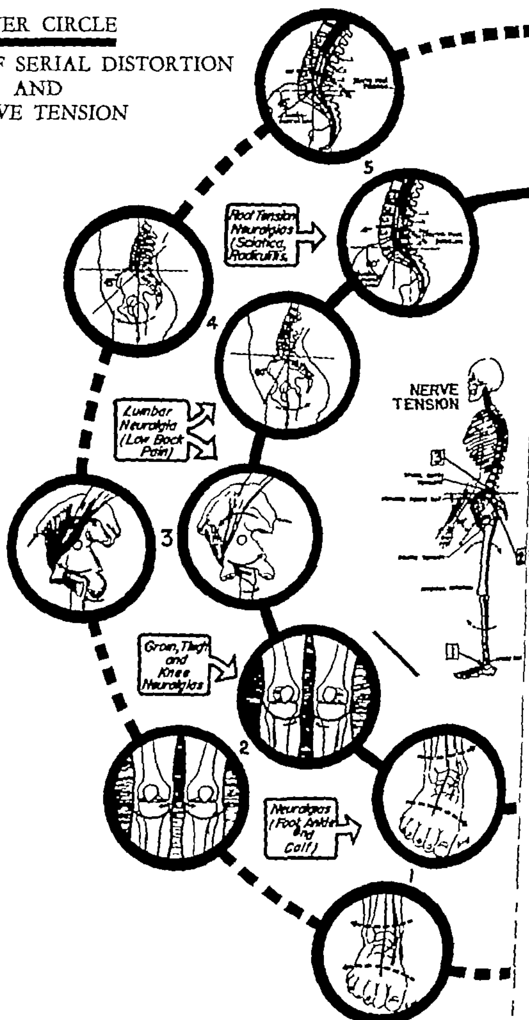


Figure 12 The Postural Complex—The Complete Contracting Mechanism

OUTER CIRCLE

THE CYCLE OF CORRECTION AND NERVE RELEASE

5

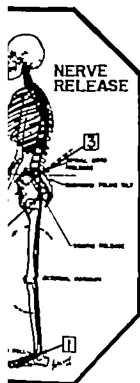
Release of Nerve Tensions

Variable Nerve Tensı

4

Reduced Lumbo-Sacral Angle (X ray) 45°

Increased Lumbo Sacral Angle (X-ray) 60°



vic Rotation on Hip Joint Crest Forward

3

Pelvic Rotation on Hip Joint Crest Backward Base Forward

Inward Roll of Leg from Top to Bottom

2

Outward Roll of Leg from Top to Bottom

Inward Roll of Foot and Angulation

1

Outward Roll to Straight-Line Weight Bearing

being largely exerted in the region of the anterior superior spine. There are undoubtedly closely related factors acting in the same area (sartorius, rectus femoris, etc.) which may aid in pulling the crest of the pelvis forward and consequently cause a corresponding backward movement of the pelvic base

The second in the pelvic series, inner circle (4) illustrates that this movement can be actually measured radiographically Such pictures are taken in the standing position by techniques that will be described in Chapter Six

The last of the triad, inner circle (5) illustrates the important clinical effect of pelvic angulation, namely that generalized elongating nerve tensions that start at the ankle are agumented by the doubled shortening pressures that must accompany pelvic shift. The upper component, viz., forward movement of the pelvic crest causes the sacral base to press forward on the terminal roots of the cauda equina. This is one of the major factors in the causation of localized low back pain The lower component or backwkard movement at the base of the pelvis exerts pressure on the sciatic nerve by elevation of the sacrospinous ligament that closes the lower apperture of the sciatic foramen. In short, the same movement that causes low back pain may produce sciatica, this combined mechanism explaining their frequent association.

The series of figures comprising the outer circle is designedly connected by broken lines to indicate that correction breaks a long interdependent vicious circle. Outer circle (1) reveals that external rotation of the foot from the previously internally rotated position tends to restore straight line weight bearing and equality of stresses on the respective component joint and neurovascular structures of the foot and ankle. With this there is the accompanying release of the primary angulating pressures at this particular point. The second outer circle (2) illustrates the effect of synchronous outward rotation of the vertical components of the lower extremity as indicated by patellar movement.

The balance of the series outer circles (3-4 5) illustrate the contrasting effects of correction on the pelvic triad The first, circle (3) reveals the change in pelvic angulation when inward rotation of the femur is replaced by outward roll With the release of varied pulls the crest springs backward and the base moves forward in an exactly corresponding degree of wheel like movement Outer circle (4) illustrates the degree of shift as determined by actual radiographic measurements (Chapter Six) Outer circle (5) the last of this pelvic triad illustrates the release of local and generalized nervous system tensions that accompany combined skeletal shifts

In the center are two skeletal figures, one labeled Nerve Tension the other Nerve Release Nerve tension arises from the composite effect of the serial deviations of the inner circle. The companion picture—Nerve Release—correspondingly portrays the result when correction at the base (foot) reverses the serial distortions of the superstructure. The numbers attached to the central figures, (1) for the ankle (2) for the sciatic foramen, and (3) for the lumbosacral junction, represent the order of their appearance from below upwards, but are not indicative of their respective importance It so happens that in the light of our present knowledge (1) or the ankle component, is undoubtedly the most important. But the pressure at (3) the lumbosacral area, is considerably more important than that occuring at the sciatic zone (2) This conclusion is based on the clinical and statistical observation that low back pain as a neuralgic symptom, not only outnumbers sciatica statistically but almost invariably preceeds it by a long time interval

In summation, *since the central nervous system is a continuous structure tension in one area must be transmitted in varying degree to all others Conversely for the same reason relaxation of tension may cause corresponding release at distant points*

Chapter Six

Radiographic Measurement of Pelvic Positions

The findings that have evolved from the radiographic measurements of the changes of pelvic positions have contributed greatly toward confirming the validity of the entire postural symptom complex Since these radically different radiographic techniques were first devised in 1946 an accumulation of evidence has confirmed the fact that postural defects in the lower extremities are correspondingly transmitted to the pelvis These are of two distinctly different types Differences of leg lengths produce lateral angulation, whereas internal rotatory imbalance frequently causes the two-ply antero-posterior displacement described in the previous chapter (Figure 12)

Difference in methods of radiographic examination can only be properly evaluated by first discussing the present status. Although pictures of the pelvis and low back region probably outnumber any other single form of radiographic examination, few will deny that in a great number of cases they fail to give significant information

It is generally recognized that many low back pains of postural or static origin becomes progressively worse on standing, and are relieved by lying down. It is therefore paradoxical that almost without exception diagnostic radiographs should be taken in pain free recumbency rather than in the standing position that is associated with pain

The deficiencies of recumbent examination have not been sufficiently stressed in the past since defects in alignment, such as spondylolisthesis, may completely escape recognition The general use of this position, when combined with the lack of agreement as to causation of low back pain and sciatica, has aided in creating great diagnostic confusion.

In contra-distinction, standing pictures as presently developed regularly give exact diagnostic findings which can be used for purposes of treatment From the standpoint of clinical value the antero-posterior views taken to determine differences of leg lengths have come to be far more important than the lateral views made for purposes of measuring the changes of lumbosacral angles In our present day routine of examination antero-posterior views are made in approximately 50% of all patients

The radiographic table is turned upright into the vertical position. A plumb line is dropped from the top mid line, and the position of this is drawn on the table. Two screws are then inserted into the table at the top and bottom as illustrated in Figure 13) To these are attached a thin wire held taut and flat against the surface of the table by a spring interposed at either the upper or lower end To prevent movement, two thin strips of adhesive or cellophane tape are affixed to the wire at its upper and lower end and also keeps it from being dislodged from the true vertical plane by movement of the patient. For both antero-posterior and lateral radiographs the patient stands as illustrated in Figures 13 and 16 A B and C. All pictures are taken using a rotating anode tube at a 42 inch target film distance. The tube is centered at or slightly above the sacroiliac dimples The 42 inch distance has been found to be the most satisfactory in that magnification is slight and does not significantly interfere with measurement Greater distances may give hazy pictures, and the same objection frequently applies to pictures taken with tubes of insufficient penetration

The actual technique of measurement as recently modified is as follows The antero-posterior pelvic radiograph is mounted on the illuminator and with a plastic geometric triangle a line is erected at a right angle to the vertical starting at the upper margin of each acetabulum Then two similar additional right angled lines are made using the upper line of the iliac crests as starting points The differences of lengths can then be read off directly by

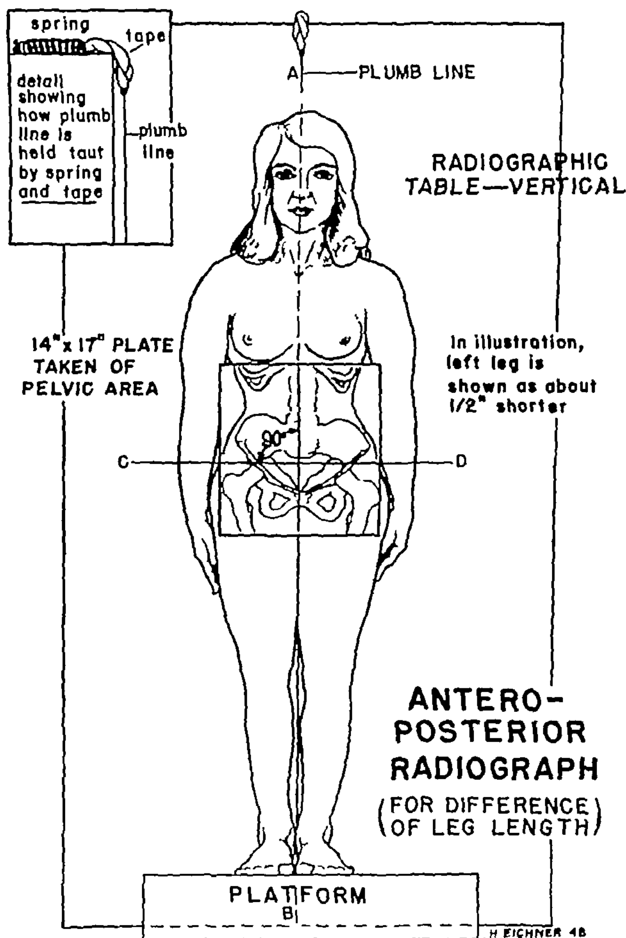


Figure 13 Antero-Posterior Radiographs for Difference of Leg Lengths.

measurements on the central line The top of the hip joint socket is somewhat more exact than the bony head of the femur as the former includes the thickness of the cartilaginous covering of the head The sacroiliac joints cannot be used as they are frequently difficult to visualize exactly The difference of leg lengths as found by radiograph examination is incorporated into fixed postural correction by raising the under surface of the heel of the shoe according to the following rule In the great majority of cases where the acetabular and iliac differences coincide for all measurements up to one inch, correction is made for only one-half of the difference. For example, if the left leg is one inch short, the left heel is raised only one-half inch, as actual clinical experience has demonstrated that full correction frequently aggravates the original neuralgias, and may even cause new ones The spinal curvatures which are the invariable product of leg length difference achieve a delicate balance that tolerates only limited change.

If the difference in leg length is 1/4 inch or less, it is usually considered to be within normal limits and consequently negligible. Further details of fixed postural shoe correction will be covered in detail in Chapter IX

Two radiographic Figures 14 A and B illustrate the need for evaluating both acetabular and iliac differences With increasing experience it has been learned that there may be as great a difference in the iliac wings as in the lengths of the legs Actually the difference in leg lengths is of importance simply for its effect on vertebral and spinal nerve root alignment. In the photographic reproduction (Figure 14A) the difference in leg lengths (13/16) is not completely reflected by a similar change at the sacroiliac levels (3/4) and the raise was correspondingly decreased In this particular case a 3/8 inch raise was found to be entirely satisfactory In Figure 14B a reverse situation was found. Here an acetabular leg length difference of 3/8 inch was found associated with an iliac difference of 3/4 inch. Therefore, the full correction of a 3/8 inch heel raise was made to the short left leg to secure a satisfactory end result.

The writer is aware that there are other radiographic techniques for measurement, but these will not be discussed except to note that they are not practical as they require a series of pictures in which the various component parts of the lower extremities are measured and the sums totaled

The chief method for the determination of differences in leg lengths now used almost universally is by exceedingly inaccurate tape measurements It is routine practice to place the patient in the supine position and then attempt to line up both legs in a straight plane in their relations to the mid line of the body With a tape, the distance from the anterior superior iliac spine to the lower margin of the internal *malleolus of the tibia is measured* Measurements that start at the umbilicus contain greater margin of error It is not difficult to prove this If several observers measure the same patient, one will get as many different answers as measurements Not infrequently some of these opinions will vary as to which leg is the shorter of the two

Inaccuracy must be expected as a result of a great number of variables To name only a few of the most important, the upper point of the anterior superior spine of the ilium and the lower point, the internal malleolus of the tibia, are both rounded thereby making it difficult to find exact starting and end points The frequent difference in circumference of legs will be included in the overall measurements Finally such measurements give the total length without differentiating as to whether the deficiency is below the hip joint, or in the pelvis

While antero-posterior pictures are made for the purpose of determining the difference of leg lengths, lateral radiographs are used to determine the change of pelvic angulation. From the various parts of the pelvis only the plane that is the top or base of the sacrum has been found suitable for use. The determination of the change in lumbosacral angulation produced by rotatory deviation of the lower extremities are taken in the following three positions

1 Patient wearing shoes with incorporated fixed postural correction, (Figure 15A)
2 In the same shoes standing on a platform which produces additional or maximum external rotation (Figure 15B) *
3 In the uncorrected position without shoes, (Figure 15C)

* The term eversion as used in Figure 15B, denotes a "rolling outward" of the foot. This is the exact opposite of the term as it is usually used in standard texts.

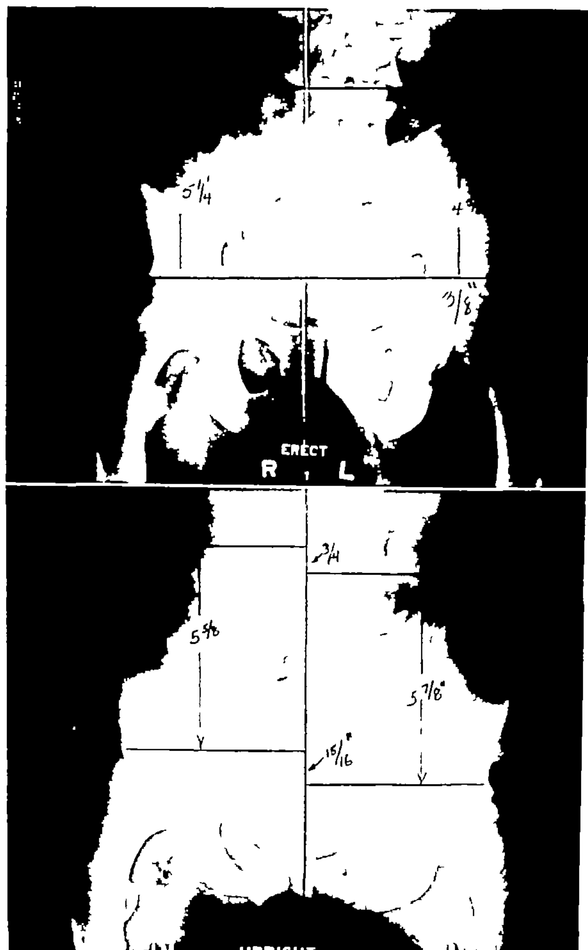
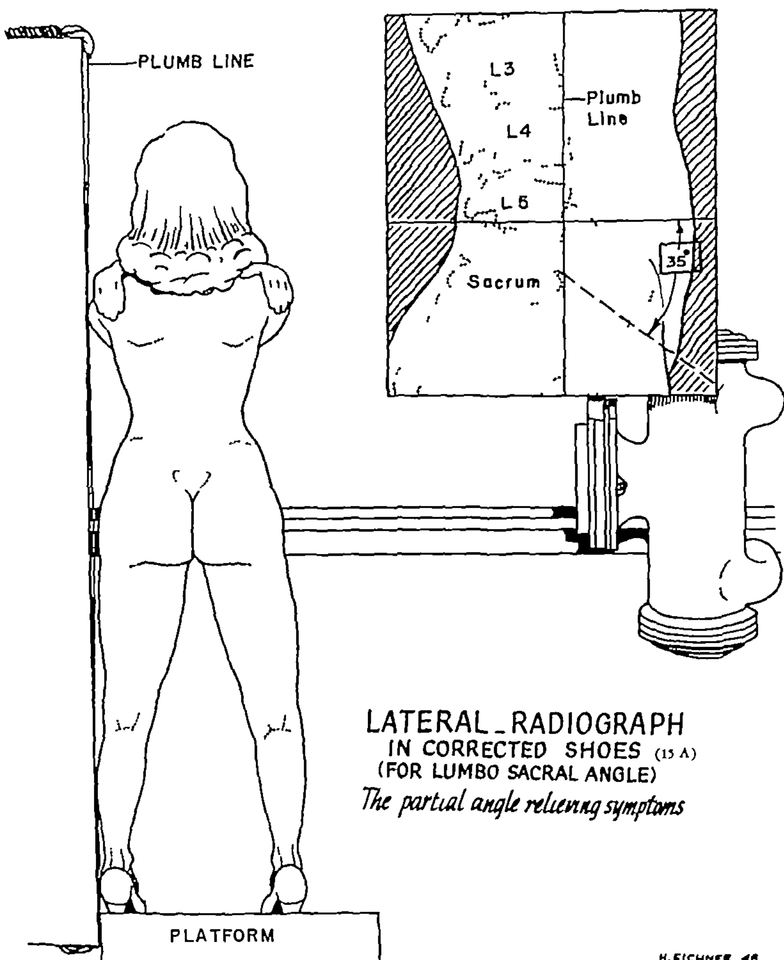


Figure 14 Techniques of Radiographic Leg Length Measurement A (*Upper*) The obsolete technique of measurement. Here the comparative shortness of the left iliac wing aggravates the over all shortness of the entire left lower extremity indicating increased correction B (*Lower*) Present modified technique for standing antero-posterior measurements Here the increased height of the left iliac wing compensates slightly for the shortness of the left lower extremity requiring de creased correction.


VIEW 2
PLUMB LINE
L3
L4
L5
Plumb Line
Sacrum
35°
LATERAL_RADIOGRAPH
IN CORRECTED SHOES (15 A)
(FOR LUMBO SACRAL ANGLE)
The partial angle relieving symptoms
PLATFORM
H. EICHNER 48

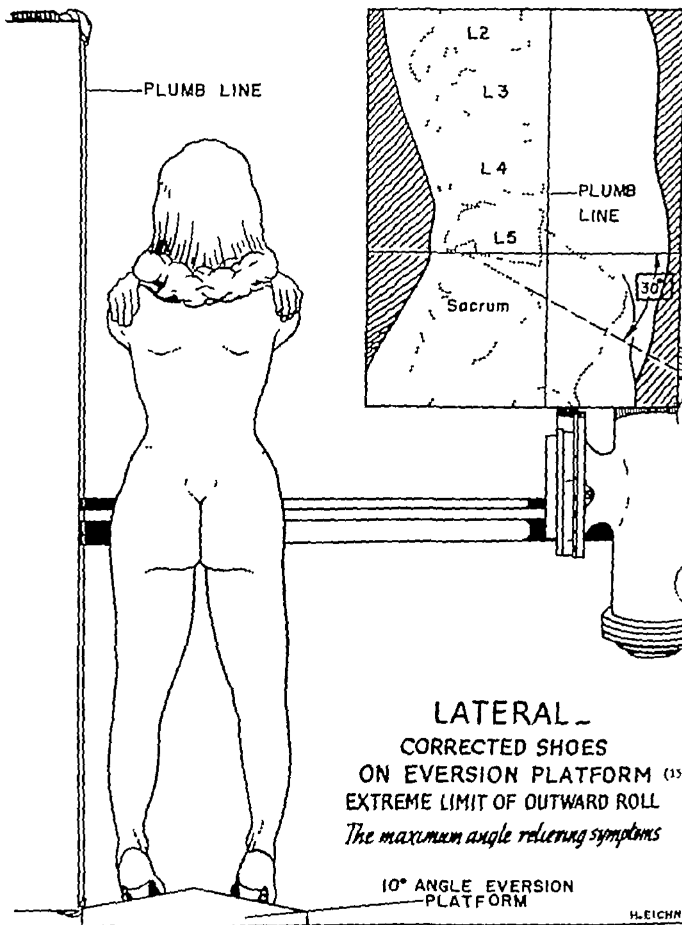


Figure 15 (*Continued*)

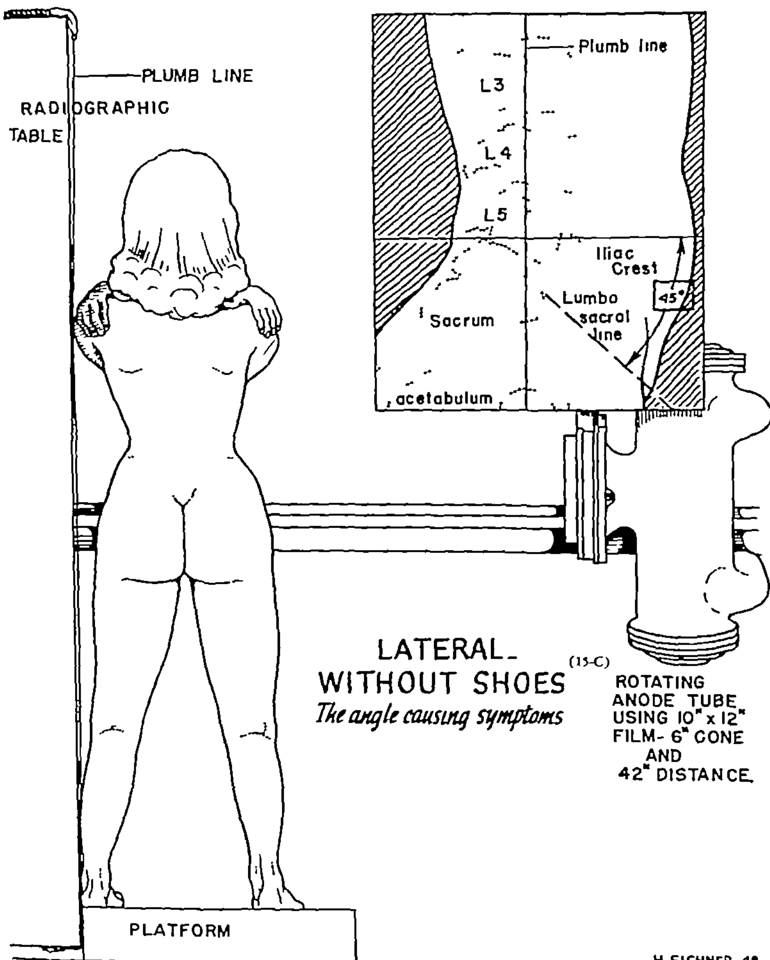


Figure 15 (*Continued*)

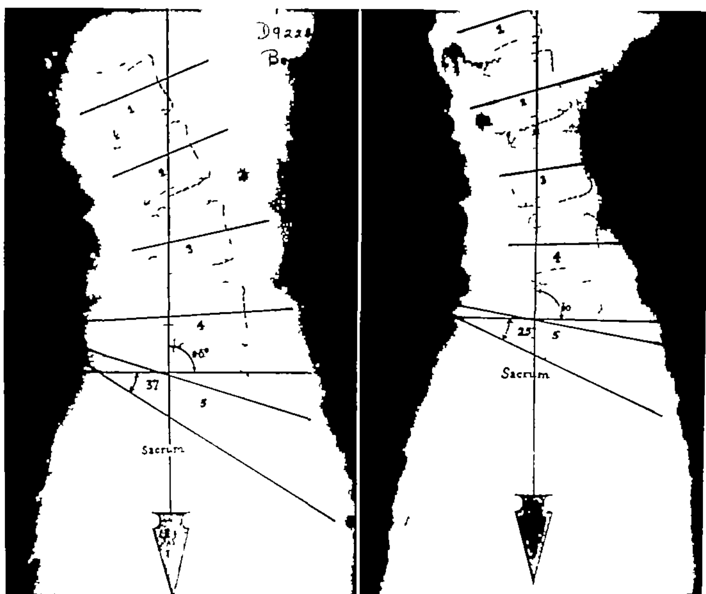


Figure 16. The First Two Cases Radiographically Demonstrating Lumbo-Sacral Shift. The change of pelvic position caused by fixed postural correction. A. Low back pain. B (*Opposite page*) Sciatica.

A lateral view is taken at the same level and in the same manner as that described for the antero-posterior view The technique of actual radiographic measurements is as follows. A transverse line is drawn at a 90 angle to the vertical at the level of the top of the upper articular surface of the sacrum. Then a line is drawn parallel to the upper sacral level The angle between the transverse and sacral line is then measured using a goniometer, or the common transparent geometric angular rule The same method of measurement is used for the second and third views to determine the changes in the lumbosacral angle produced by alteration of foot and leg rotation.

Experience has taught us to take the first and second views in the corrected shoes, with the third or last picture taken in the uncorrected position without shoes In certain so-called hair trigger back cases the assumption of the barefoot (uncorrected) position may immediately excite latent lumbar muscle spasm to give a false reading in subsequent pictures For this same reason lateral pictures are not taken in the early phases when pain and muscle spasms serve to lock the pelvis in malposition. As a result the high hopes originally held for the clinical value of this particular test has steadily decreased, in that they fail to give early significant information that can be used for purposes of treatment. They are therefore taken after the subsidence of symptoms particularly when there have been frequent recur

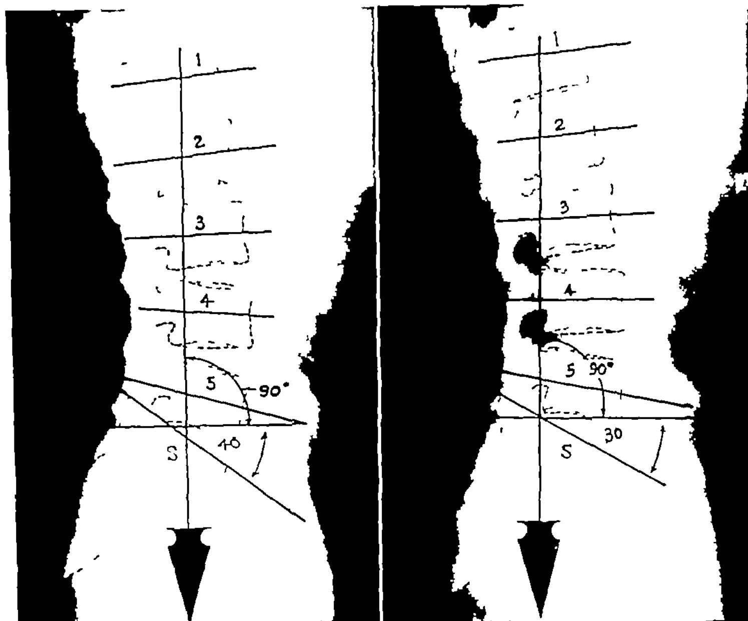


Figure 16B (*See legend on opposite page*)

rences In such cases the second view on the outward rotation platform (Figure 15B) may give positive information that the recurrence comes from insufficient correction. In association they demonstrate conclusively that pelvic movement is definitely related to rotatory changes in the lower extremity and have been a keypoint in establishing the related anatomical mechanisms that cause nerve tensions

Of special interest are the first two cases in which this association was detected more than seven years ago

Mrs C.E.A. had been suffering from the varied neuralgias for more than 15 years Her chief complaint was chronic low back pain, but with it were associated upper root neuralgias, such as tightness in the back of the neck, tinglings in the arms paresthesias in the legs and intense generalized fatigue. The severity of her complaints were such as to cause her to seek almost continuous attention There had been great differences of opinion as to causes of symptoms from excellent sources. Here examination revealed severe internal rotatory deviation of the legs as a part of general postural imbalance. With this diagnosis the patient was given fixed postural shoe correction to release local and generalized spinal cord tension, and adjuvant therapy for aggravation due to secondary inflammation. At the end of six weeks there was complete relief of the varied pains coupled with a disappearance of fatigue In an attempt to determine the possible effect of rotation of the legs on pelvic angulation the patient was placed in front of a vertical plumb line and lumbosacral measurements were made in the corrected shoes Another picture was made at the same time barefoot. Comparison of the two views reveal

that correction of internal rotatory deviation caused a 12° shift in the lumbosacral angle (Figure 16A)

The second case, Mr M.G., was made shortly after the first one. Here the chief complaint was intractable sciatica of four years duration. It had been intermittent during the first two years, but in the past two years had been practically continuous Because of the severity of his complaint he had been under continuous treatment from varied sources receiving several positive diagnoses for disc protrusion with operation advised but deferred by the patient's decision Examination here revealed *extreme third degree internal roll with marked long arch descent*, (extreme pes planus) Fixed postural shoe correction and adjuvant therapy brought complete relief in about two months. With the relief of pain and muscle spasm, comparative radiographs revealed a 10° shift. Significantly this patient has been seen at intervals for the past seven years and still has a hair trigger spinal cord in that even slight corrective sag brings a mild recurrence of symptoms (Figure 16B)

A study of these pictures and others that follow will reveal that in every case pelvic movement is predominant and is greater at this point than in the adjacent 5th and 4th vertebrae. It would seem that this pelvic movement is communicated in lesser degree to the 5th lumbar vertebrae, with still less to the 4th, and beyond this point, antero-posterior change in vertebral alignment from pelvic shift can not be demonstrated This is a normal phenomenon, and when demonstrated on the operating table, does not constitute a valid reason for the performance of fusion This constant movement in this narrow vertebral segment may be one of the major reasons for disc degeneration and protrusion. Most authorities agree that the overwhelming majority of such defects occur in these two interspaces—between the 4th and 5th lumbar vertebrae, and the 5th lumbar vertebrae and the sacrum.

Standing radiographs by determining the pelvic malposition in the antero-posterior and lateral planes are an indispensable essential to proper diagnosis and treatment Both must be accurately evaluated measured and corrected if substantial benefit is to be regularly obtained

CHAPTER SEVEN

The Primary Trigger Mechanism

SYNCHRONIZED INTERNAL ROTATION OF THE LOWER EXTREMITY (FOOT LEG AND THIGH)

THE PRECEDING CHAPTER has demonstrated that serial distortion of the entire superstructure is triggered by a primary internal rotation of the foot. That this particular mechanism is responsible in a large measure for the varied symptoms that regularly accompany postural imbalance will probably be greeted with considerable skepticism. If so, this will be considered as an entirely natural reaction, for the writer himself shared this view for a long number of years However when the summation of evidence from personal and independent sources became overwhelming, there occurred a gradual transition from doubt to certainty

Because of the relative importance of this starting point it shall be dealt with in considerable detail, particularly as it is believed that synchronized rotation has not been previously recognized Once attention has been called to this physiological phenomenon, one is puzzled to find reason why it has not been previously described

As a basic preliminary one cannot appreciate the great variance in the concepts of physiological movements without first examining those described in current standard English texts In all of these the terminology of movement is based on observations made with the patient in the sitting position, or in recumbency rather than in the standing weight bearing position of function. It would seem essential therefore, to devise a set of terms that should not only conform to the facts of functional anatomy and physiology but that they should be so contrived as to be readily understood by all. Such is not the case at this time as will be seen by the following examples of textual confusion

There is reasonably complete agreement on the range of motion at the ankle joint in dorsi and plantar flexion Movements of the foot on the ankle in the sitting or recumbent position are more complex (see Figure 17) In this position (sitting) if that portion of the lower extremity from the knee to the ankle (leg) is held in a fixed position, the foot can be intoed or adducted or outtoed or abducted Maintaining the same position or fixation for the leg, now let the foot assume a position in which the sole is elevated on its inner border This is variously termed inversion or supination. Still maintaining leg fixation, the foot is now rotated so that the outer border is elevated while the inner border of the sole remains in contact with the floor This opposite movement is termed eversion or pronation.

Let us examine two standard texts in which an attempt is made to simplify what is obviously a complicated problem Chaos is piled on confusion when these particular movements are considered in combinations Quoting directly from Hauser [10] page 20

For the sake of clarity it is necessary to define other movements of the foot (other than plantar flexion and dorsi flexion) supination is a rotary movement in the longitudinal axis in which the great toe is lifted away from the floor whereas pronation is the opposite movement in which the small toe and outer margin of the foot are elevated. *These movements take place in the foot itself* Since pronation and abduction are nearly always combined, either one of these terms is used to describe this combination of movements In this text the term eversion will be used for this combination of movements for the combination of supination and adduction the term inversion will be used

On the same subject Lewin [11] states

[10] Hauser Emil, D W., *Diseases of the Foot* 2nd ed. Philadelphia, Saunders, 1950

[11] Lewin, Phillip *The Foot and Ankle* 3rd ed. Philadelphia, Lea and Febiger 1947 p 56

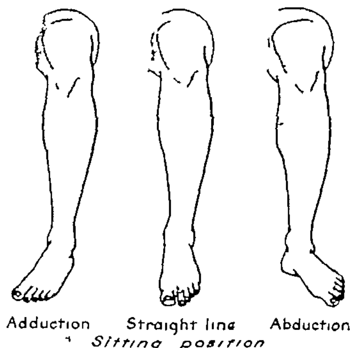


Figure 17 Non weight bearing independent movements of foot at ankle joint.

When a foot is everted and adducted there is usually an upward and outward rotation of the medial bones of the mid tarsal region namely the scaphoid and the first and second cuneiform bones This constitutes supination. If a foot is everted and abducted, the reverse occurs, that is downward and inward rotation of the medial mid tarsal bones, i.e., pronation. A foot that is inverted adducted and supinated is in varus position, whereas a foot that is everted, abducted and pronated is in valgus position The following table will be found useful in remembering these terms.

Inversion	Adduction	Supination	Varus
Eversion	Abduction	Pronation	Valgus

This is simplification?

In contra-distinction to these two opinions which lay great stress on intrinsic movement within the foot, the following quote (Lake [13]) indicates the extreme diversity of opinion under the sectional title Destiny of the Human Foot.

Indeed, we are forced to the conclusion that the evolutionary destiny of the human foot is to the production of a rigid structure having an arched form but *devoid of any movements other than those at the ankle and the toe joints* If this view be correct, then the adoption of unyielding and limiting footwear by man was functionally but an anticipation of a general evolutionary trend perhaps this enforced restriction of movement has tended to increase the degree of evolutionary rigidity reached at the present day but it cannot be held responsible, as it so frequently is, for all the many static troubles affecting the feet. The tendency of the modern foot to become rigid is an evolutionary one not dependent upon the adoption of footwear

It is difficult to leave this subject without reference to another aspect The modern ideas of the maintenance of bodily poise, overshadowed as they are by the importance of postural tonus, place the ligaments in a very insignificant and secondary position, and there can be no doubt that previously their importance has been unwarrantably exaggerated. When one observes the size and strength of many of the important ligaments, however it is impossible to escape the conviction that they subserve a more important function than mere runners-up to the muscles, coming into action only when the latter fail The sacro-iliac ligaments mentioned above seem to show that in certain circumstances and positions they form the first line of support, and it is our argument here that such circumstances and positions are also to be found in the human foot

[13] Lake, Norman C *The Foot* 3rd ed. Baltimore, Williams and Wilkins, 1945 p 26

The position taken in this monograph is very close to that of Lake, but it should be noted that in none of these is there mention of synchronization—that foot movements cause corresponding movements of the other segments of the lower extremity (leg and thigh) This altered concept of movement should be preceded by an analysis of normal gait.

This synchronization is illustrated in the two accompanying composite sets of Figures 18 A and B In the upper tier of five figures the propulsive phase of gait is viewed from the side, and in the comparative lower set, from the front. In between each propulsive phase there is a swing or resting period. This will not be described nor will it be necessary to elaborate the fact that almost every structure of the body enters into normal gait. One exceedingly important factor is the shifting of the entire body weight to alternately lie over each propelling lower extremity This sway tends to disappear when rapid gait overcomes inertia.

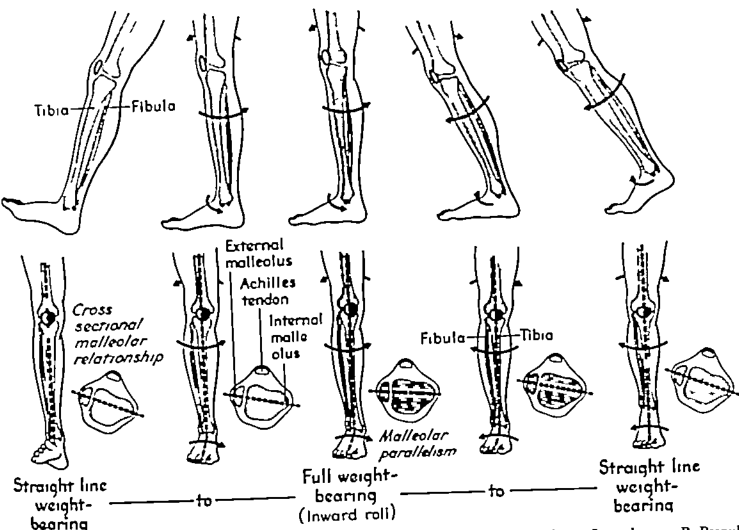


Figure 18. The Complete Segmental Synchronization of Normal Gait. A. Propulsive phase—Lateral view. B. Propulsive phase—Antero-posterior view.

The upper tier illustrates the previously described heel to toe phase of the cycle as viewed from the side. In this view antero-posterior motion seems to predominate, although close inspection will reveal that rotatory movements accompany each change of position.

In the lower tier the heel to toe cycle is viewed from the front, this view giving a better demonstration of the rotatory shifts that accompany each phase of propulsion. As the heel touches the ground we have straight line weight bearing. But as weight begins to fall on the foot it rolls towards its inner border accompanied by the synchronized equal rotation of the remainder of the lower extremity. This reaches its zenith at the moment of full independent weight bearing. Immediately after this instant the succeeding two figures illustrate the tendency to return to the straight line, as body weight is shifted to the opposite leg.

The following basic conclusions control almost every aspect of diagnosis and treatment that will be presented later.

1. *Human gait is basically unstable in that we stand on two feet but walk on one—one foot at a time.*
2. *The foot is an exceedingly small off center base for a very large superstructure, the body.*
3. *With the complete alternation of bipedal gait at the instant of full weight bearing, full body weight is directed toward the inside border of the foot.*

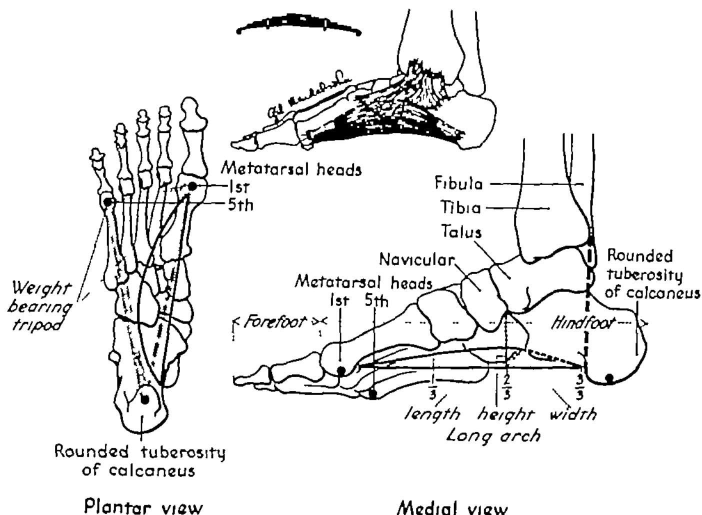


Figure 19 The Skeletal Rigidity of the Foot. A. Skeletal structure of the foot—Plantar view B Skeletal structure of the foot—Medial view C. The spring structure of the longitudinal arch of the foot.

4 *Inward roll of the foot and leg is inescapable*
5 *Faults in foot posture in varying degrees are almost universal*

The development of certain musculo-skeletal structures of the entire lower extremities, and particularly in the foot, have made this unique type of humanoid bipedal gait possible. In a preceding chapter (Figure 5 A, B and C) there was demonstrated the evolutionary progression of pre-simian, anthropoid, and human feet, and the improvement of posture that accompanied loss of prehensility viz., the trend toward rigidity

The accompanying figure (Figure 19 A, B and C) illustrates in three different ways the fact that the human foot, even in its present incomplete stage of development, has become practically a single rigid structure from the metatarsal heads to the posterior aspect of the calcaneus. Midtarsal movement in ordinary standing or weight bearing has practically vanished and, when still present, may constitute a significant defect by reason of navicular sag Such feet are properly termed weak or "flat feet, the term meaning that *habitual internal weight deviation has caused a break in long arch structure*

Our terminology of the intimate anatomy of the ideal, if not the normal foot, would seem to need revision. Ordinarily the hind foot (tarsus) is described as the collection of tarsal bones as distinguished from the fore foot which consists of the five metatarsi and their respective phalanges. The evolutionary trend towards rigidity is well advanced as the human foot as now constituted has incorporated the metatarsals into the tarsal bones to form a unitary structure The inner border is eccentrically elevated to form a longitudinal arch (Figure 19B) while the heads of the 2nd, 3rd, and 4th metatarsi are slightly elevated to form a transverse or metatarsal arch (Figure 19 A and B) The highest point of

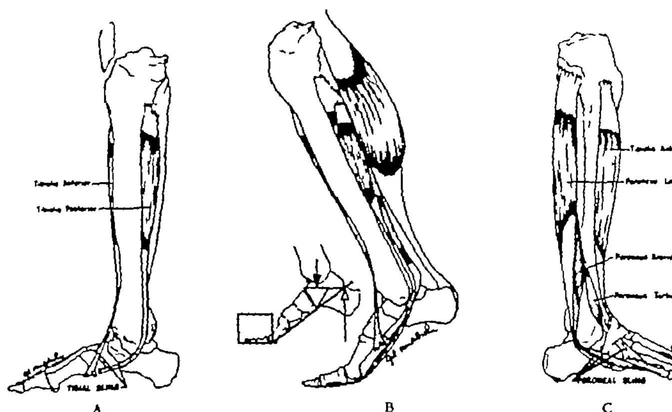


Figure 0 The Primary Muscular Factors Controlling Foot Movement. A. The internal tibial sling B Internal view of the propelling lever action of the calf muscles. C. The lateral peroneal sling D The essential symmetry of the balancing slings.

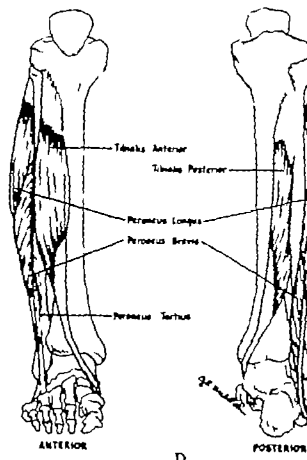




Figure 21 The Comparative Effect of Rotatory Movements of Feet on Talar Position. A (*Upper*) Internal rotation. B (*Middle*) Neutral (straight line position)—anatomical (ideal) norm. C (*Lower*) External rotation.

(*Continued on opposite page*)

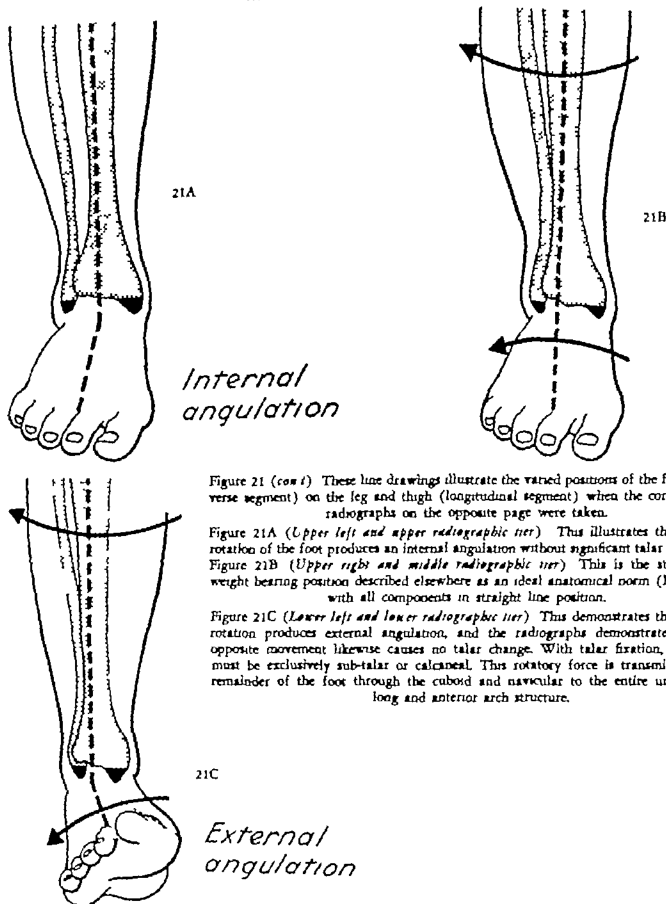


Figure 21 (*con't*) These line drawings illustrate the varied positions of the foot (transverse segment) on the leg and thigh (longitudinal segment) when the corresponding radiographs on the opposite page were taken.

Figure 21A (*Upper left and upper radiographic tier*) This illustrates that internal rotation of the foot produces an internal angulation without significant talar movement.

Figure 21B (*Upper right and middle radiographic tier*) This is the straight line weight bearing position described elsewhere as an ideal anatomical norm (Figure 21) with all components in straight line position.

Figure 21C (*Lower left and lower radiographic tier*) This demonstrates that external rotation produces external angulation, and the radiographs demonstrate that this opposite movement likewise causes no talar change. With talar fixation, movement must be exclusively sub-talar or calcaneal. This rotatory force is transmitted to the remainder of the foot through the cuboid and navicular to the entire unitary rigid long and anterior arch structure.

the long arch is at the talo-navicular junction being placed slightly behind its center. Laterally this elevation of the long arch becomes slightly higher at the 2nd and 3rd metatarsal shafts, with the lift descending rapidly as we approach the outer border of the foot to permit the bodies of the 4th and 5th metatarsals to make contact to the surface.

In the ideally externally rotated weight bearing

position there is reason to believe that the 4th participates almost as much as the 5th to sustain the greater portion of the body weight The shorter outer longitudinal or cuboid arch of the foot is actually non-existant except in the bared skeleton as in life this apparently open space is filled by the heavy plantar ligamentous, muscular and cutaneous structures

The unitary hypothesis of the arch structure of the foot will be visualized by projecting the central elevation of the shafts of the 2nd, 3rd and 4th metatarsi forward to include the heads Of necessity therefore, the heads of these bones will be correspondingly elevated to form an anterior or metatarsal arch. *This structure has acquired a dignity it does not actually possess since the anterior arch is only the front end of the long arch* In all probability its sole function is to act mechanically as a transverse spring just as do the longitudinal components of the long arch (see Figure 19C) *

Although in most texts the toes are considered as being of considerable importance, it would seem that in the human they are steadily losing their functional importance and shrinking in size. All of the small toes have become practically valueless save as a means of preserving cosmetic symmetry and this is beginning to apply to the large toe as well. *Confirmation is afforded by the fact that patients that have had amputations of all five toes from varied traumata frequently walk normally without even the vestige of a limp*

With the rigid foot acting as a primary lever there will be described the related musculo-skeletal structures below the knee that control the propulsive phase of gait. Figure 20 A, B C and D illustrates different facets of this particular problem. In the first (Figure 20A) is portrayed the inner aspect of the foot and leg with the origins and insertions of the tibialis anterior and posterior Acting as a unit these combine to constitute a tibial sling which rotates the foot toward its outer border A companion figure (Figure 20C) views the outer aspect of the foot and leg to depict the origins and insertions of the peroneus longus, brevis and tertius. These grouped insertions form a lateral or peroneal sling which rotates the foot towards its inner border The universal tendency to inward roll is due more to the off-center position of the foot and other anatomical factors than to inadequacy of the internal sling

In the central figure (Figure 20B) is demonstrated diagrammatically the calf muscle or major propulsive factor (the combined gastrocnemius and soleus) acting in combination with the balancing internal (tibial) and the external (peroneal) slings The insert depicts the fact that this is essentially a simple physical lever of the first class, similar in its effect to a crowbar placed beneath a log.

Figure 20D demonstrates the essential symmetry of the balancing internal and external slings as seen from in front and from behind Here particular attention is called to the external placement of the heel bone in the posterior view another prime factor predisposing to the universal internal rotatory deviation

While analyzing the details of the effects of rotation the following evidence pertains to the role of the talus Since it is completely without muscular connection it has become a passive rather than an active factor The next set of three figures (Figure 21 A, B and C) are accompanied by radiographic inserts illustrating the position of the talus in both antero-posterior and lateral views that accompanies synchronized movements In the center is an illustrative study of the foot and leg in the ideal neutral or anatomical position (Figure 21B) On the left (Figure 21A) there is a comparative study of internal angulation, and on the right (Figure 21C) is a similar set illustrating the effect of external angulation It should be noted that although there is a deviation in the lines of weight bearing and certain malleolar changes that have been and will be described again, there is no significant change in talar position. It has become, certainly as regards rotatory deviation, like the fibula, a complete tibial satellite in that it follows tibial movement while firmly ensconced in the tibio-fibular mortice. This same limitation does not apply to antero-posterior movements.

* This concept is confirmed by an overwhelming volume of clinical evidence. To relieve anterior arch descent and metatarsalgia the first requisite is to correct long arch deviations. Universal failure to recognize this would seem to account in large measure for the millions of chronic sufferers who have received only limited benefit from the present conventional methods of treatment (anterior arch supports alone without supplementary correction, flexible supports, flexible shoes, etc.)

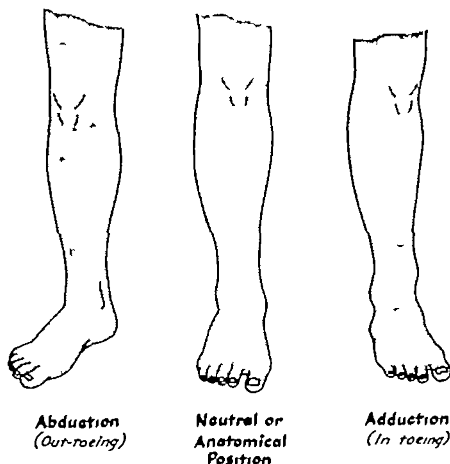


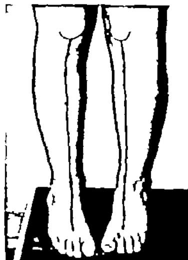
Figure 22. Linear Synchronization of Lower Extremity Movement (Standing)

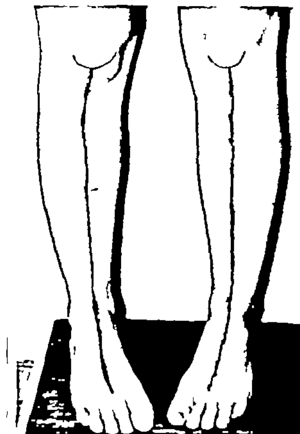
Preliminary considerations would not be complete without the inclusion of an illustration (Figure 22) and a series of actual photographs (Figure 23 A B and C) that demonstrate additionally that every rotatory movement of the foot in the standing position, causes corresponding movements of the remainder of the lower extremity from the ankle to the hip This particular series demonstrates that abduction (outtoeing) and adduction (intoeing) are linear movements of the combined segments of the lower extremity acting as a unit. They are completely independent of the individual movement of the foot (transverse segment) on the remainder of the lower extremity (longitudinal segment—leg and thigh) in that these can occur in any one of the three positions

For purposes of comparison there are placed in the center (Figure 23B) a photograph illustrating a linear neutral or anatomical position in which the inner borders of the feet parallel At the same time, and in the same picture, the foot is also in the neutral position in its relation to the remainder of the lower extremity viz., straight line weight bearing To the left of this picture is illustrated the effect of internal rotation of the foot, and to the right, the effect of external rotation

The series of photographs (Figure 23 A, B, and C) illustrate a similar phenomenon when the entire lower extremity is in the intoed (adducted) neutral or outtoed (abducted) position. While the degree of rotation of the foot on the ankle decreases with abduction and increases with adduction, the abducted position is more productive of symptoms as there is a greater deviation of weight towards the inside border of the foot.

The effects of internal rotation of the foot on the ankle joint are demonstrated in the two superimposed outlines of the foot and ankle (Figure 24) The figure enclosed by the straight line represents an ideal anatomical standard or norm, one approximated by the foot and leg in the sitting or non weight bearing position The other enclosed by broken lines, demonstrates the composite effects of weight bearing Taking the ideal norm as the starting point attention is called to the following the malleolar relationship and appearance, the straight





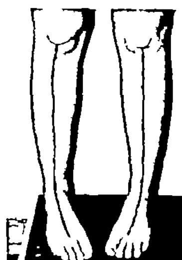
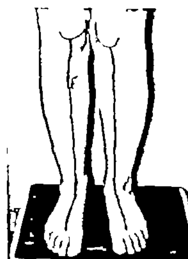
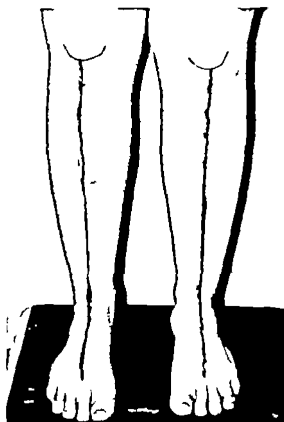


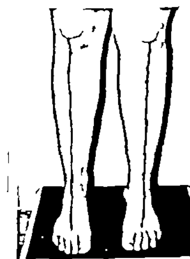
Figure 23 Rotatory Movements of the Foot at the Ankle Joint in Each of the Three Primary Linear Positions.

Internal Rotation — A—The Intoed (adducted) Linear Position, Straight line weight bearing — External Rotation

(Continued on opposite page)







Internal Rotation — B—The Neutral Linear Position (Inner borders of feet parallel) Straight line weight bearing — External Rotation

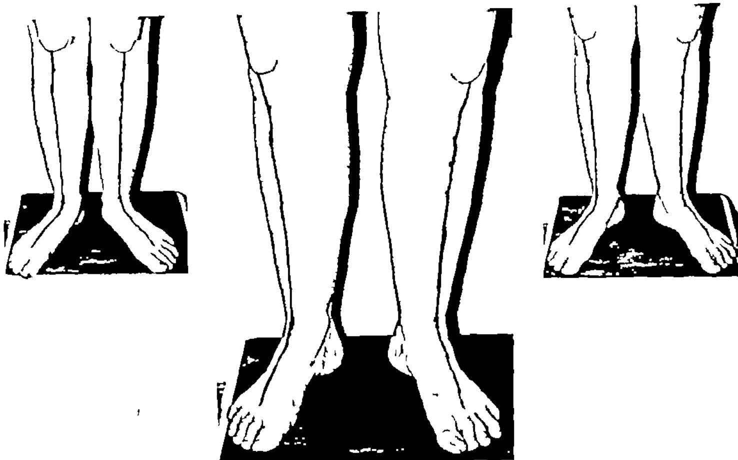


Figure 23 (*continued from opposite page*) Particular attention is called to the fact that in each of the three primary linear synchronized positions viz., (1) Intoeing, (2) Straight line neutral, and (3) Outtoeing, rotatory movements of the foot are distinctly independent. This differs markedly from the usual text book descriptions (pp 43-44) which considers them to be closely related.

Internal Rotation — C—The Outtoed (abducted) Linear Position — External Rotation

Straight line weight bearing

line of weight bearing, and the retention of long arch symmetry

Taking these up in order in the sitting or non weight bearing position, the foot and ankle revert toward their ideal or undistorted anatomical relationship There is a retention of long arch symmetry If a vertical plane were constructed that transversely bisected the leg at the ankle level the internal malleolus of the tibia will be found to be well anterior whereas the external malleolus of the fibula will be found to occupy a corresponding point posterior to this artificial mid line. Therefore, if a wire were to be inserted connecting the central points of the malleoli, it would be found to make an angle of 30 to 40 from these transverse internal and external points Similarly if a line were drawn down the anterior mid point of the leg and foot this would approximate a straight line.

In the figure enclosed by the dotted line these criteria are compared as they are affected by weight bearing The foot will roll towards its inside border viz internal rotation With internal deviation of weight there is a lowering of the long arch. With the complete synchronization the ankle will rotate internally in exactly the same degree and amount of movement. In fact, after prolonged consideration, this series is the most important in demonstrating the action of the primary trigger mechanism This pattern becomes apparent when other changes are analyzed

The malleolar relationship changes radically as the internal malleolus (tibia) moves backward and slightly downward, while the external malleolus (fibula) moves forward and slightly upward When the synchronized foot and leg rotation reach the extreme physiological limits the two malleoli become almost, but never completely parallel a condition termed *relative malleolar parallelism* With this there is a significant diagnostic accompaniment, the *external malleolar bulge*

An original cross-section at the ankle joint has been found to differ materially from those previously described Figure 25A, is an outline reproduction derived from Gray's Anatomy [12] The other later

[12] Gray Henry *Anatomy of the Human Body* Philadelphia, New York, Lea and Febiger 1918, Figure 357

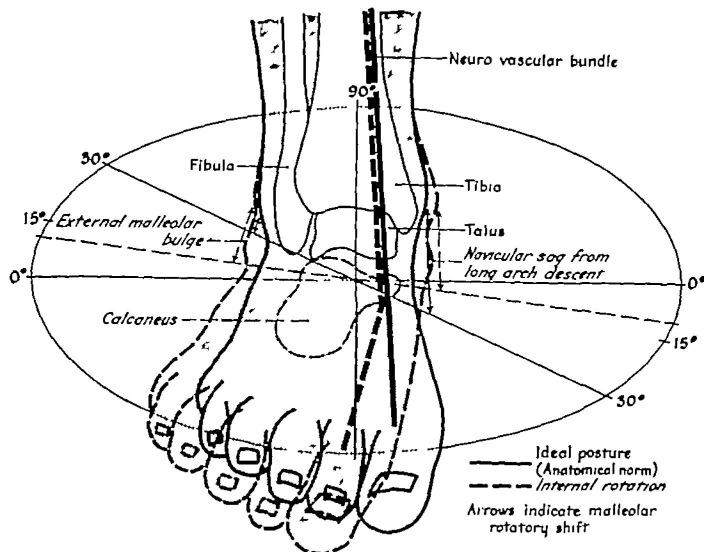


Figure 24 The Primary Trigger Mechanism (superimposed figures) The Anatomical (ideal) Norm and the Multiple Effects of Internal Rotation of the Foot.

comparative study is similarly derived from Lewin (Figure 25B) [11] Both of these outlines reveal

1 *The talus and calcaneus to be of approximately equal size*
2 *The lower border of the talus and the upper border of the calcaneus are in complete contact in the subtalar joint*
3 *The subtalar joint is shown as being predominantly transverse in plane with stability aided by a slight central cupping*
4. *In the first figure (Figure 25A) the lower tip of the calcaneus is pointed while in the second (Figure 25B) there is a flattening of the calcaneal tuberosity*
5 *The neuro-vascular bundles are not in close contact with the under surface of the sustentacular shelf Both show a slanted central talo-calcaneal ligament*

It is suggested that these two figures be compared with the actual cross-section (Figure 26A) The differences are so profound that there is reason to believe that not only are these figures derived from each other but that they are diagrammatic approximations rather than actual anatomical specimens

In contra-distinction to the above the cross-sectional specimen (Figure 26A) reveals the following

1 *The calcaneus is both relatively and actually much larger than the talus*
2 *The talus and calcaneal bodies are not in com*

[11] Lewin, Philip *The Foot and Ankle* 3rd ed From Eycleshymer and Jones, Philadelphia, Lea and Febiger, 1947 Figure 7

plete contact throughout their full extent but only in the outer half

3 *The subtalar joint is not transversely level, but slants sharply downward from without inwards with no trace of either a central cupping or a central talo calcaneal ligament*

4 *The section is in front of the tuberosity of the calcaneus as indicated by a portion of the plantar aponeurosis*

5 *All of the major plantar neuro-vascular bundles with a single minor and insignificant exception lie close to the inner border of the calcaneus two of them lying directly beneath and in contact with the lower border of the shelf like sustentaculum tali*

The two companion figures (Figure 26 B and C) are diagrams based on the actual cross section (Figure 26A) To the left, in Figure 26B is illustrated the trend toward straight line weight bearing found in the sitting or non weight bearing position As a result there is an equal distribution of weight bearing stresses in the ankle joint. It should be noted that only in this ideal position are the outer halves of the lower articular surface of the talus, and the upper articular surface of the calcaneus in contact. In this position there is no pressure on the neuro-vascular bundles

When Figure 26C is compared with Figure 26B there is illustrated the distortion that accompanies weight bearing The calcaneus rolls towards its inner border The slanting nature of the subtalar joint with its plane directed downwards from its lateral toward its medial aspect, aids and abets this universal inward rotation of the foot from weight stress

The primary trigger mechanism by which movements of the foot cause changes in the remainder of the lower extremity and even in the superstructure, are better demonstrated in these illustrations than in any others That this movement is almost purely rotatory is conclusively demonstrated in that ligamentous tension on the inner side of the ankle is matched by an exactly concomitant equal relaxation on the outer surface. Of paramount importance is the effect of this sustentacular descent on the neuro-vascular bundles immediately in contact with its internal under surface This is a highly critical angle in that at this exact point the terminal branches of the posterior tibial neuro-vascular bundles shift from the longitudinal to the transverse plane to become the plantar branches on the under surface of the foot They are therefore actually hooked beneath the descending sustentaculum.

A Comparative Study of Ankle Mortice Transections.
FIGURE 25A AND B

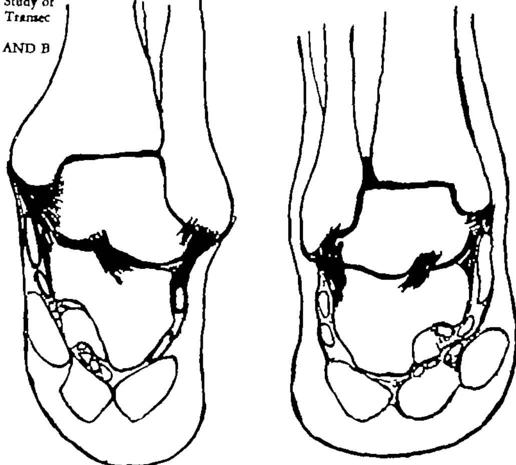


Figure 25A. Schematic outline based on an early cross sectional study B. Schematic outline based on a later cross sectional study

Because of their importance to the basic anatomy and physiology of stance and gait the three varied portrayals of ankle mortice transections merit a detailed comparative study For this reason certain descriptions found in the text (pp 53 54, and 55) will be repeated and amplified. The first two (25 A and B) are re-drawn from standard texts, the third (26 A) is an actual vertical cross-section on a line bisecting the internal tibila malleolus

The second (25 B) by perpetuating many significant errors would seem to be derived from the first (25 A) Both vary so greatly from the actual cross-section as to give the impression that they are diagrammatic approximations rather than true anatomical sections. In the first (25 A) the subtalar joint is slanted downward toward the fibular side, in the second (25 B) it is slightly cupped and both are in complete contact. In the actual section the slant is reversed (downward toward the tibial malleolus) and there is incomplete contact The central slanted ligament would completely block subtalar movement and is a figment of the artist s imagination. Neither 25 A or B show the plantar aponeurosis which begins at the anterior margin of the calcaneal tuberosity a point just posterior to this level (see Figure 19)

The actual cross-section demonstrates clearly the heavy ligamentous connections fixing the talus to both malleoli, probably the anatomical basis for talar fixation. Certainly as regards rotatory motion this bone has become almost as complete a tibial satellite as the fibula.

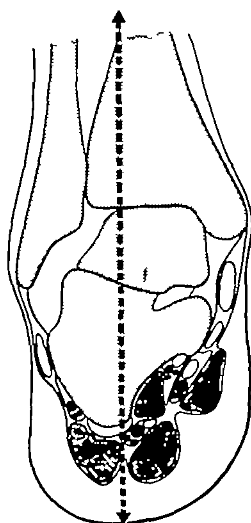
The heavy ligamentous connection between the tibial malleolus and the sustentaculum tali suggest the anatomical mechanism of synchronized rotation (*The Trigger Mechanism*) With sustentacular descent the main pull is downward, but with talar fixation this must be transmuted into a rotatory motion in the subtalar joint.

The results of this descent and localized pressure on the blood vessels and nerves has been termed ***angular compression*** The retention of long arch symmetry by making this angle more acute, may actually increase pressure and symptoms Clinical observations tend to support this for while it has been found that lowered arches (flat feet) predispose to foot and leg pains the varied upper neuralgias are more frequently found in high arched feet. This same observation applies to vascular deficiencies primarily caused or secondarily aggravated by sustentacular pressure. The frequent complaint "I can walk five miles, but can t stand still for five minutes only means that sustained pressure of standing rather than the intermittant one of walking, is more likely to produce symptoms Such complaints are pathognomic of postural neuralgias

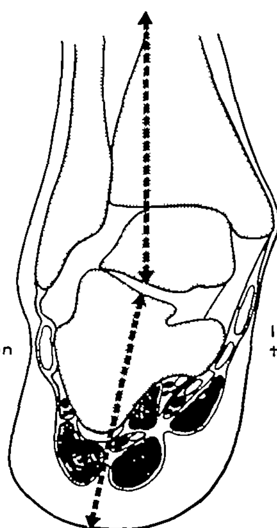
The preceding portion of this text has been devoted to the varied causes of postural symptoms. Different approaches to the complex problems of diagnosis and treatment will be discussed in the following chapters

A Comparative Study of Ankle Mortice Transections
FIGURE 26A, B AND C

Fibula
Tibia
Talus
Lig deltoideus
Tendo m tibialis posterior
Tendo m. peronaeus brevis
Calcaneus
Tendo m. flexor digitorum longus
Lig laciniatum
Tendo m peronaeus longus
M abductor hallucis
Tendo m flexor hallucis longus
Aponeurosis plantaris
Vv, a et n plantaris medialis
M. quadratus plantae
M abductor digiti quinti
Vv, a et n. plantaris lateralis
M flexor digitorum brevis



External relaxation



Internal tension

Straight line weight-bearing

Internal rotation with inward angulation

Figure 26A. Transverse cross-sectional study through the center of the ankle mortice. B-C. Diagrams based on cross-sectional study Lower left (26C)—The *Angular Compression* of the neuro-vascular bundles caused by the descent of the sustentacular shelf through internal rotation of the calcaneus—*THE PRIMARY TRIGGER MECHANISM*

PART III

DIAGNOSIS

CHAPTER EIGHT

The Postural History and Physical Examination

POSTURAL DEVIATIONS exist from the cradle to the grave, but the symptoms arising from distortion vary greatly at different age levels All generalizations are subject to exceptions but in the main, the defects of infancy childhood, and adolescence, are largely cosmetic. With the changes that accompany age progression, these earlier defects give rise to a great variety of other symptoms

Treatment directed toward the alleviation of these symptoms, primarily caused or aggravated by postural imbalance, must be concerned with the correction of deviation, but before this can begin many diagnostic points must be elicited through the history and physical examination This chapter is mainly concerned with adult diagnoses leaving special techniques for children for a later chapter

POSTURAL HISTORY (Figure 27A)

ADDRESS — REFERRED BY
TELEPHONE — BUSINESS
AGE — BUSINESS TELEPHONE
CHIEF COMPLAINT — DURATION
PRESENT HISTORY
- Generalized Fatigue
  - (Type, Character, Effect of change of position, Allied Symptoms)
- Neuralgias
  - Upper (C 1 to D-2)
    - Fixed
      - (Pain or tightness at base of neck, etc.)
    - Movable
      - (Neuritic)
    - Paresthesias
      - (Tinglings, Numbness of fingers, etc.)
  - Middle (Thoracic)
    - Fixed
    - Movable
    - Paresthesias
  - Lower (Lumbo-sacral)
    - Fixed
      - (Low back pain—Acute or chronic, Sciatica, Other pains in lower extremity including type of foot pain)
    - Movable (Neuritic)
    - Paresthesias
      - (Burnings Numbness, Tinglings, etc.)

PAST HISTORY
- (Illnesses, Injuries, Operations, Previous treatment, etc.)

Figure 27 Postural Outline Forms A. Postural history B The postural physical examination. C. Foot examination.

THE POSTURAL PHYSICAL EXAMINATION
(Figure 27B)

GENERAL APPEARANCE
- Weight
- Gait
- Stance

SPINAL EXAMINATION
- Standing
  - Straight
  - Curvature
    - Functional or C-curve
    - Structural or S-curve
    - Lordosis
    - Spinal movements forward
    - Side bending
- Supine
  - Joint Examination
    - Hips Knees, Ankles (Movements, measurements for differences)
  - Straight leg raising tests
    - Angle of limitation from tightness (hamstring contracture)
    - Angle of limitation from pain and muscle spasm
  - Crossed leg tests (heel to opposite knee)
    - (Type of pain evoked and location)
- Prone (Note type of movement in changing from supine to prone position)
  - Hyperextension leg tests
    - Lumbosacral fixation and muscle spasm
    - Pain referral
  - Rotatory leg tests (Knee bent)
  - Fibrositic thickenings
    - Gluteal
    - Lumbosacral area, etc.
    - Cervical area, etc.
  - Finger fork tests to spinous processes
    - Segmental root pains
    - Sciatic openings

NEUROLOGICAL EXAMINATION
- Reflexes—Knee jerks, heel jerks, etc.
- Sensory examination

RADIOGRAPHIC MEASUREMENTS
- (All pictures taken standing before vertical plumb line copper wire, 42 distance, tube focused at lumbosacral joint)
  - Anteroposterior for difference in leg length
  - Lateral (in corrected shoes) the angle of backward shift
  - Lateral (on eversion platform) angle of complete range of shift
  - Lateral (without shoes) uncorrected angle of inward roll

FOOT EXAMINATION
(Figure 27C)

FOOT EXAMINATION STANDING
- FOOT AND LEG ALIGNMENT
  - *Straight legs*
  - Torsional deformities
    - (Bow legs, knock knees, etc)
  - Habitual Position
    - Intoeing (1st, 2nd, or 3rd degree)
    - Outtoeing (1st, 2nd, or 3rd degree)
- FOOT CONTOUR
  - Retention of symmetry
  - Long arch descent
    - (Pes planus) type and degree
  - Hollow or claw foot
    - (Pes cavus) type and degree
- SPECIAL TESTS FOR INWARD ROTATION
  - General bimanual rotatory test
    - Individual (right and left) estimate of degree
      - (mild, medium, severe)
    - Circulatory reaction
      - (blanching time)
  - Finger (Fine) plantar fascia tests

FOOT EXAMINATION SITTING
- FOOT (SHOE) DEFORMITIES
  - (Type and severity—right and left)
  - Bunions
  - Bunionettes
  - Callouses
    - (dorsal or interphalangeal)
  - Location of painful pressure points
- INSPECTION OF METATARSAL AREA
  - Metatarsal descent and mobility
  - Toe contracture
    - Movable
    - Fixed (hammer to
  - Size and location of p
    - Relative shortness
- HEEL CORD LENGTH
  - Past right angle
  - To right angle
  - Short of right angle
    - (5 10 15)

A series of outline forms covering the specialized details of the postural history and physical examination have been prepared for office use (Figure 27 A, B and C) In presentation, this chapter will follow this order

CHIEF COMPLAINT

The first point in the postural history will be the chief or present complaint, the location, and duration. In a large number of cases it will be found that the neuralgia of the present chief complaint is only one of a large number the one that is greatest at that particular moment If the chief complaint is chronic low back pain, almost without exception, the patient will give a history of repeated attacks of acute transient low back pain over a period of many years

PRESENT HISTORY

This section serves to amplify information concerning the chief complaint. However because generalized fatigue is so frequently associated with the chronic neuralgias, there is close questioning as to the presence, or absence, of this important symptom Many will at first deny its existence as it has been so slowly progressive as to escape notice Specific inquiry will reveal that the patient rides rather than walks even short distances In many the fatigue is of such severity as to make it a presenting symptom, or even a chief complaint. Characteristically postural fatigue is promptly relieved by lying down, to recur quite as quickly on resuming the upright position In the end stages a number have been forced into a wheel chair or bed existence to secure relief

In the presence of intense fatigue the questioning may be broadened to determine the mental, and particularly the emotional status of the patient Mental depression may be aggravated by the all too frequent diagnoses that their numerous complaints are of imaginary or psychosomatic origin. Particularly is this the case if they are told that they have an incurable condition and must live with it *This is indeed a cheerless prospect well calculated to depress the mind* The exponents of psychosomatic conflict may ponder on the above statements *It may well be that they have been looking at the wrong end—the primary cause is not in the brain, but in the feet*

The next topic in the history outline—the neuralgias—constitutes by far the most common cause from which patients seek medical relief The word neuralgia indicating altered nerve reaction rather than the term pain has been chosen advisedly Not infrequently numbness tinglings or burning sensations, may be quite as annoying as a pain of considerable intensity Although questioning in every patient is directed toward eliciting information as to the location of single or multiple neuralgias there are certain characteristics that serve to identify postural neuralgias from those due to other causes

Of the utmost importance is the finding that change of position, viz changing from the upright to recumbency or vice versa, brings an alteration of intensity Many patients will volunteer that the symptom was formerly influenced by change of position but at present has become practically continuous This has considerable diagnostic significance indicating that secondary inflammatory changes have been added to those of primary spinal cord tension

Moveable pains and parasthesias are ordinarily inconstant and are considered as due to tension without secondary inflammation Conversely if from the onset change of position did not materially affect the particular neuralgia under consideration this tends to eliminate postural causes Diagnostic attention is then directed to the other causes of nerve reaction (tumors systemic conditions producing alterations in nerve structure, etc.) *Pains at different levels constitute a finding of considerable significance particularly if they follow the set pattern to be described later*

PAST HISTORY

This portion is devoted to recording past illnesses operations and previous treatments These may give considerable information. The common childhood diseases do not seem to have a great influence on imbalance This is not the case with poliomyelitis or the many other diseases which in themselves cause or aggravate pre-existing deviation Significantly many report variable pains in childhood which when severe, have been diagnosed as rheumatic, when mild as growing pains.

All too frequently there is a past history of many

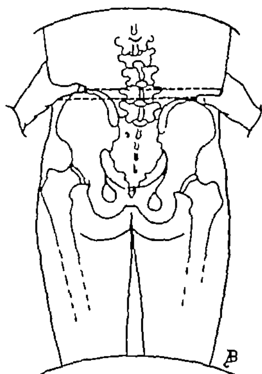


Figure 28. Estimation of Leg Length from Iliac Crest Differential.

operations for the relief of specific neuralgias A very high percentage of females having acute or chronic low back pain have had numerous ineffective pelvic operations

POSTURAL PHYSICAL EXAMINATION

General Appearance In many cases long continued chronic pain will be reflected in the patient's expression, response to questioning, etc. The weight is noted, but in this technique great stress is not placed on variations from the normal It may well be that patients who are seriously over or under weight may be more subject to neuralgias, but it would seem that this is an aggravating rather than a primary factor In any case, as far as this individual routine of treatment is concerned, the dietary factors have been largely and purposely neglected without affecting in appreciable measure the results of treatment However it is realized that marked adiposity adds special difficulties to fixed postural correction

Abnormalities of gait and stance are noted and, not infrequently have considerable influence on subsequent diagnosis and treatment. The presence of lumbar or sciatic list—flexion of knees hips, or spinal curvature toward the affected side—is invariably associated with tension and often with inflammation of the lower lumbar roots, or their sciatic continuations

SPINAL EXAMINATION

The spine is bared to a point below the waist and foot and leg coverings removed. Examination is made in three different positions—standing, supine and prone recumbency In the Standing Position the spine is first examined with the hands at the side. The spinous processes of the vertebrae are inspected to determine their relative positions, whether there is normal alignment or deviation and its exact type If they are in a straight line but if there are abnormal forward curvatures (lordosis) or backward deviations (kyphosis) in any zone, this anteroposterior displacement is recorded If there is a deviation from the straight line, lateral curvatures are noted and described as to type—total functional, C-curve, or structural S-curve If a C-curve, this is described as being either a left or right total curve. The S-curve types are listed as mild, moderate, or severe, with a description of the location of the separate curves, (left cervico-dorsal, right dorso-lumbar etc.) Confirmatory evidence of standing postural deviation is listed, such as forward shoulders, difference in height of shoulders, abdominal protuberance, and determination of comparative iliac crest levels (Figure 28) Where a crest difference is found, or in the presence of any lateral curvature, an anteroposterior radiograph (standing) for exact determination of the difference in leg length becomes a diagnostic requisite (Chap 6)

The standing examination is concluded by certain functional tests The patient is instructed to bend forward as far as possible without bending the knees, in an attempt to touch the tips of the extended fingers to the floor noting the partial or complete success of this movement The degree of forward lumbar curvature is noted, whether normal or limited. Similarly side bending, first to one side and then the other is tested to determine variations in functional performance Following each movement, the patient is questioned as to the localization and type of pain referral.

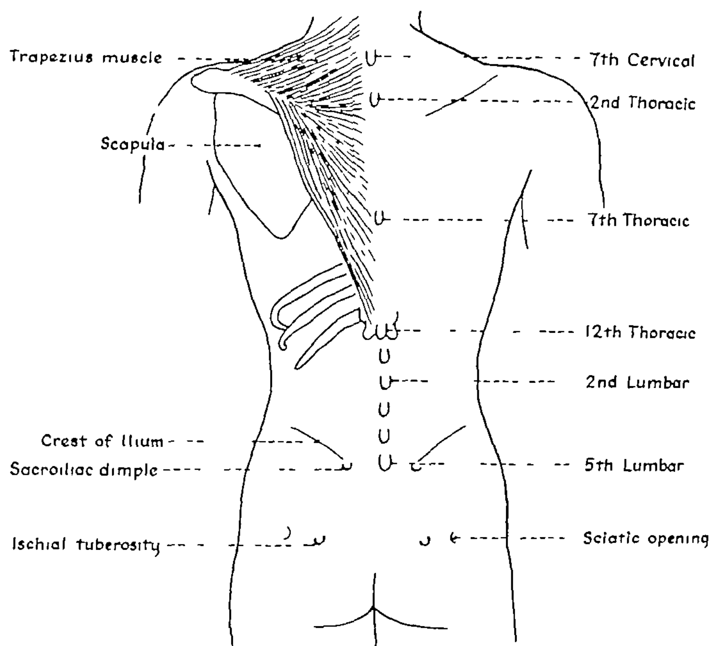


Figure 30 Diagnostic Localization—Posterior Surface of the Trunk. A. Surface anatomy of spinal nerve root localization. B (*Opposite page*) Fibrositic pattern of secondary inflammatory changes.

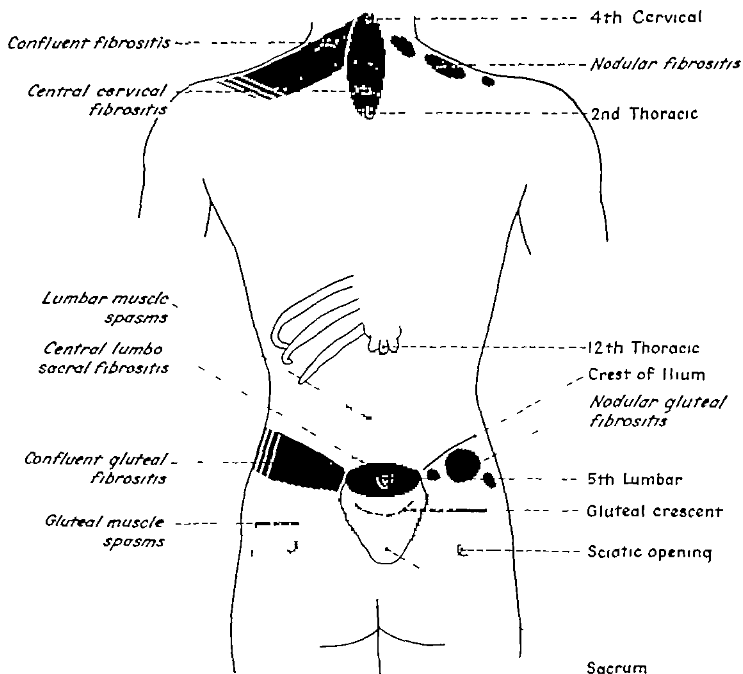


Figure 30B (*See legend on opposite page*)

rotatory thrust causes pain it is usually indicative of nerve inflammation.

The third portion of the spinal examination requires that the patient shift from his previous one of Supine Recumbency to one of Prone Recumbency The mode of movement used by the patient to effect this change of position has great diagnostic significance and should be observed closely The patient with genuine nerve tension, with or without secondary inflammation will effect this by fits and starts, usually described as breaks in the continuity of movement The malinger however will upset his claim to have pains of great severity by shifting in one single easy movement

Just as there are two leg tests in the supine position, there are two other comparable tests made in prone recumbency The first is the *Hyperextension Leg test* (Figure 29C) This consists in first flexing the knee to the right angled position The ankle of the leg to be tested is grasped with one hand while the other is placed on the lumbar area. The ankle is lifted straight upward to hyperextend the thigh at the hip joint The effect of this movement is noted for the following reactions—first, whether or not it occasions a bend at the lumbosacral joint and if rigidity is accompanied by lumbar muscle spasm. Where the spasm is intense, there may be no movement whatsoever but in intermediate cases of moderate nerve tension, or tension with slight inflammation, there may be a small initial movement followed by complete rigidity Each leg is tested in turn recording the type of reaction and pain referral, viz., lumbar sciatic, upper root levels, or combinations of these

The fourth in the series is the prone *Rotatory Leg test* (Figure 29D) This was once known as the Hibbs test and is obsolete as an indicator for sacroiliac relaxation. With the leg in the same position as described for the Hyperextension test, the hand grasping the ankle thrusts sharply from inside out, and the presence or absence of pain referral is noted.

The significance and importance of the four spinal leg tests must be discussed as a group since they form a distinct diagnostic pattern. The *Straight Leg Raising test* of the recumbent position stretches the sciatic nerve and communicates this tension to the spinal cord in flexion, whereas the *Hyperextension test* produces the same effect in the opposite direction. In both, stresses are applied in the longitudinal plane and in themselves do not differentiate tension from inflammation. Both the Heel to Knee test of supine recumbency and the Rotatory Leg test of the prone position are indirect rather than direct tests. The first causes a stretching of the hip joint ligaments, the second a sharp rotatory impact of the head of the femur against the acetabulum. As such they give information as to the effect of nearby movement on sciatic and lumbar nerves and therefore, if positive, indicate that to nerve tension has been added secondary inflammation The combined information of the leg tests serve to influence both prognosis and treatment

The information secured by inspection and palpation in the prone position gives a wealth of significant information (Figure 30 A and B) These particular findings have gone far to establish the definite pattern of symptoms found in the Postural Complex

The first of the companion figures (Figure 30A) identify key points of surface anatomy The spinous processes of the vertebrae can be localized for descriptive purposes as follows The 7th cervical at the base of the neck has the longest spinous process, termed the prominens With the arms at the side, the outer border of the scapular spine and the inferior angle of the same bone are approximately at the same level as the 2nd and 7th thoracic vertebral spinous processes respectively The lower margin of the last floating 12th rib accurately demarcates the 12th thoracic vertebral spinous process, and the one just below is the first lumbar spinous process. The sacroiliac dimples are at the level of the 5th lumbar spinous process, and points between these two are localized by counting upwards or downwards The iliac crests and the relation of the sciatic foramen to the ischial tuberosities are adequately illustrated in Figure 30A. These key points localize the positive findings indicating the inflammatory reactions in the subcutaneous tissues nerves muscles, ligaments and joints (Figure 30B)

Starting from below upwards, the lumbosacral line is palpated. In a great number of cases there is a definite thickening at the base of the sacrum between the two sacroiliac dimples This may be localized or extend laterally just below the iliac

crests, and may be either confluent or discretely nodular The common central lumbosacral fibrositus may extend into the nearby corners of the gluteal muscles causing a simulated or pseudo-sciatica. Palpation when continued above the lumbosacral level may demonstrate uni or bilateral lumbar muscle spasm. When continued below pressure may demonstrate uni or bilateral gluteal muscle spasm, intensified by pressure over the sciatic openings

Palpation is continued upward on both sides of the spinous processes But in the vast majority of all cases, there is scant fibrositic thickening until one reaches the level of the second thoracic spinous process From this point upward to the 4th cervical process there can be found in a great number of cases an oval fusiform central cervical fibrositic thickening frequently extremely painful on pressure. Extending from the upper border of this thickening laterally to follow the upper border of the trapezius are thickenings which may be confluent or nodular At this point in the examination the upper border of the trapezius muscles are grasped to determine if there is muscle spasm While the tendency toward nerve tension is almost equal in both sexes the fibrositic thickenings are predominately female The prone examination is concluded by localizing the affected nerve roots

The *Finger Fork test* derives its name from the use of finger tip pressure to the sides of each spinous process by the extended and forked index and middle fingers This pressure is applied from below upwards at points about two inches from the mid line. The 5th, 4th, and 3rd lumbar etc., are tested in turn all the way from the lumbosacral line to the cervico-occipital junction at the base of the skull When a tender zone is found at any level, lumbar thoracic, or cervical, the tenderness of the two sides is compared to determine whether right is greater than left, or vice versa.

The *Neurological Examination* unless there are special indications, consists of noting any changes in reflexes—knee heel ankle clonus etc. Should the patient complain of sensory changes—numbness, tinglings, burnings etc these are mapped with cotton applicator and pin pricks In the greater number of these patients extensive neurological examinations have been made elsewhere by competent neurologists or neurosurgeons with conflicting findings and diagnoses

The next point is the Radiological findings ordinarily limited at the time of first examination to an exact determination of the difference in leg lengths This has been described in detail in chapter six

The postural examination continues with a detailed examination of the feet and legs in the Standing Position As developed in this technique, the standing examination is divided into three phases

1 Foot and leg alignment.
2 Foot Contour
3 Special tests for inward rotation

Before attempting to determine deviation one must establish an ideal or standard position, not necessarily a normal one For this term, as ordinarily used, describes the majority or average of a large number as in normal weight or height. Since postural faults are almost universal, a normal or average would therefore be a foot and leg showing varied degrees of imbalance. An ideal, on the other hand, is an artificial standard in which there is little or no deviation in weight bearing lines

In an ideal position the feet are straight ahead, neither outtoed nor intoed with their inner borders parallel. At the same time they are in the position of straight line weight bearing, neither inwardly nor outwardly rotated. With this imaginary line in mind, the first point of examination in the standing position consists in determining whether the patient has relatively straight legs or whether there is torsional deformity in either upper or lower segments of the lower extremities Next, habitual standing position is determined viz., the deviation of the foot and leg from the combined straight line position (degree of intoeing or outtoeing)

The next point of the standing examination consists in determining foot contour or shape The ideal foot is certainly not a normal one The ideal foot should have the inner border of the long arch well elevated and all of the toes in the straight line anatomical position. From this anatomical or ideal standard of contour the great majority of all feet vary greatly but can be divided into two main classes First, the weak, relaxed, or flat foot (pes planus) and second, the opposite extreme, the rigid

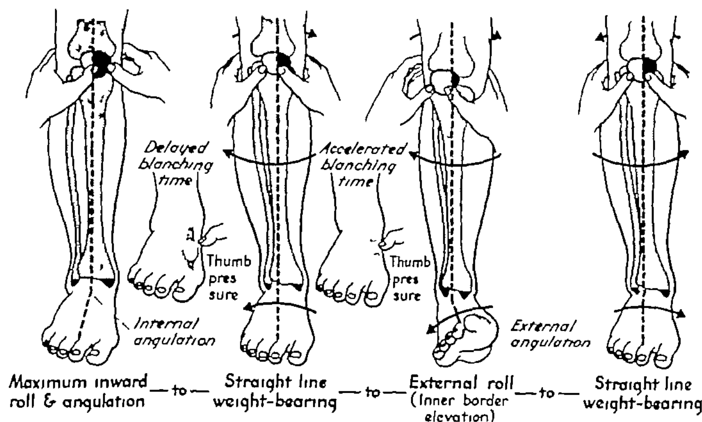


Figure 31 The General Universal Bimanual Rotatory Test.

hollow or claw foot (pes cavus) characterized by a long arch that is higher than the standard. Simple inspection should determine whether the foot belongs or tends toward the weak (flat) or high arched types Not only are there innumerable variations but not infrequently the feet in the same patient may vary greatly For example, one foot may be high arched with a complete retention of symmetry while the other may have a lowered or even flattened long arch. The influence of this individual variation will be discussed later Whatever the foot contour or correction, it is the degree of inward rotation that is of prime importance

The mechanics and appearance of rotatory imbalance have been previously described and illustrated (Figure 24) By means of Special Tests, the degree and character of rotatory deviation of each leg must be tested separately in the standing position. For this purpose the General Bimanual Rotatory test is routinely used (Figure 31) This is based on the physiological phenomenon that has been previously described, namely that in the weight bearing position every rotatory movement of the foot causes an exactly corresponding degree of rotation in the entire lower extremities, from the ankle to the hip joint But the test itself is based on the exact converse of this principle, namely that in the standing position every rotatory movement of the leg causes a corresponding movement of the foot.

The leg to be tested is grasped firmly by both hands at the knee joint and then rotated outward In order to perform this test satisfactorily it may be necessary to request the patient to shift the major portion of his weight to the opposite leg to eliminate the fixation that accompanies full weight bearing At the same time an assistant may be required to place a finger on the outer border of the foot to block the tendency of the foot to slip outward as this movement is performed As the leg rotates outward longitudinally the foot rotates correspondingly in the transverse plane. As an accompaniment, weight will shift from the inner border of the foot to permit an elevation of the depressed long arch. Although this will not occur completely in flat feet, where there is a major retention of symmetry the long arch will immediately spring back into the anatomical position. With this, malleolar distortion disappears at the ankle joint with the internal malleolus moving

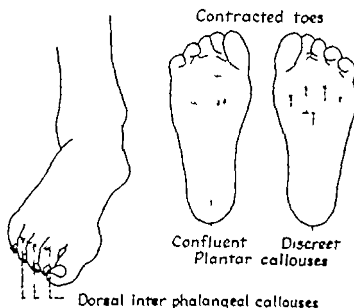


Figure 33 Certain Common Types and Locations of Foot Callouses.

knee is then rotated slightly outward and it will be found that there is an immediate relaxation. Frequently the rotatory change needed to effect this *may be very slight. Yet even this slight rotation may* be the cause of distant symptoms

Examination is concluded by a series of observations and measurements made in the Sitting Position. In this position the distortions that accompany weight bearing tends to disappear permitting the foot to assume the anatomical or ideal standard to be approximated by correction.

The first point in this portion of the foot examination is a description of the presence or absence of postural foot (shoe) deformities, their type and severity It is recognized that there is a large number of congenital anomalies that affect the feet, but this is a special problem not pertinent to our considerations This does not apply however to a multitude of shoe deformities that may complicate the problems of foot correction

The presence or absence of bunions (Hallux valgus) should be listed and whether they are simple exostoses or bony overgrowths accompanied by angulation. The prominence of the internal surface of the first metatarsal head should be described together with the location and type of exostosis (bony prominence) present, (lateral, dorsal, or in combination) and whether this is accompanied by secondary inflammation of the overlying bursa. If there is angulating adduction the extent should be noted, viz., whether mild, moderate, or severe, and the effect of this displacement on the remainder of the small toes In cases of maximum severity the large toe may overlap to lie over or under the first small toe. The significance of major deformities on corrective precedures will be discussed later

A bunionette (tailors bunion) is an enlargement on the lateral surface of the head of the 5th metatarsal. It derives its name from the sitting crossed leg position habitually used by tailors in which the weight falls for long periods on the outer surface of the foot. Although this has given this deformity its name, actually it is an extremely common lesion almost invariably due to ill fitting shoes

Foot callouses furnish conclusive evidence of either past or present shoe pressure or deviation in weight bearing stress (Figure 33) Their presence, type, and location should be noted, whether they are plantar dorsal, or interphalangeal. Toe callouses, except those of the plantar variety are invariably due to shoe pressure and the greater number will disappear promptly when shoe pressures are removed There are, however a few in which long continued shoe pressure has resulted in the development of a small underlying needle-like bony exostoses Certain of these require that the interphalangeal exostoses be removed before relief can be obtained.

Visual inspection of the foot in the Sitting Position now concerns itself with the under surface. At this point finger pressures are used to confirm the findings of observation to determine localized painful pressure points These may be found under the heel, long arch, or at any point in the anterior arch *segment. The presence of plantar callouses their* type and location is noted. Ideally but certainly not normally in the female foot when it is elevated to eye level, there is a concave elevation in the central portion between the two anterior points of the weight bearing tripod, viz., the heads of the 1st and 5th metatarsal bones With descent, and its invariable accompaniment toe contracture, elevation of the foot to eye level will reveal that with central metatarsal descent, concavity has been replaced by convexity (Figure 34, A and B) This central area, as a result of internal weight deviation, is occupied by a series of discrete or heavy confluent plantar callouses.

Thumb pressure, as illustrated in (Figure 34C) will not only elevate the lowered central metatarsal heads, but straighten the toes as well. After the metatarsal region has been examined for posture, mobility is tested by extending the toes in the plantar direction (Figure 34D). At the same time the relative length of the 1st and 2nd metatarsal bones can be determined. In many chronic painful varieties motion will be sharply restricted or even fixed at the metatarso-phalangeal junction. Since toe flexion contractures are almost invariably associated with metatarsal descent the type and character of this lesion should be determined at this time. The rigid fixed types are termed hammer toes.

The final point in the sitting examination of the foot consists in a determination of individual heel cord lengths. With the thigh and leg in the completely extended straight position the foot is externally rotated to the straight line position. The foot is dorsi flexed until movement is blocked by heel cord



Figure 34. Foot Inspection and Functional Tests. A (*Upper left*) Ideal metatarsal concavity. B (*Upper center*) Central metatarsal descent and convexity with a large confluent plantar callouse. C (*Upper right*) Thumb pressure elevating central heads and straightening toes. D (*Lower left*) Plantar flexion test of toes to determine mobility of metatarso-phalangeal junction. E (*Lower right*) Technique for testing heel cord lengths.

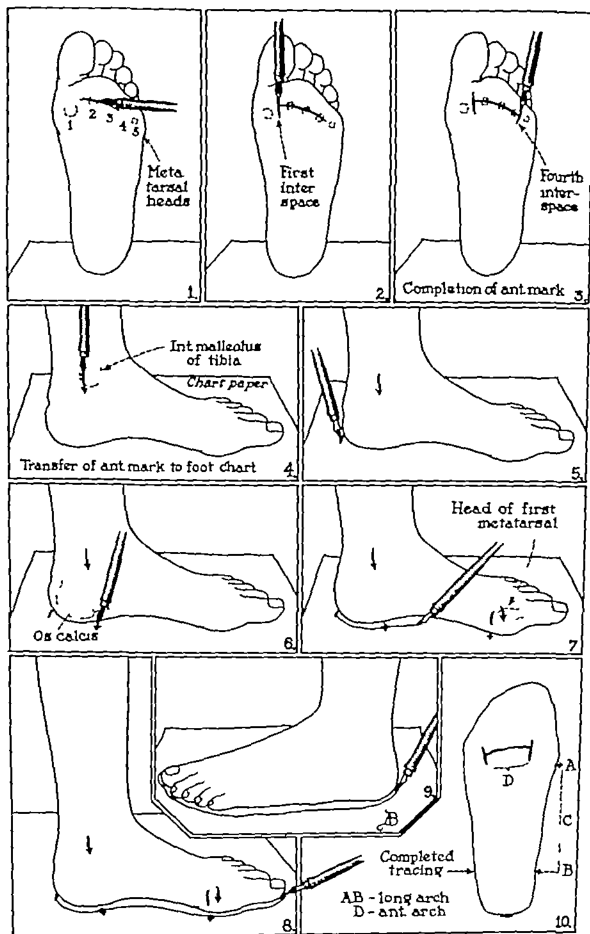


Figure 35 Serial Order for the Preparation of the Foot (Measurement) Chart. Measurements are always made in the sitting rather than the standing position With the elimination of weight distortion all feet tend to return towards the anatomical straight line norm—the position closely approximated by correction.

tightness as illustrated in Figure 34E The point at which this occurs is noted as to whether right angle position is attained If the heel cords are too long as in children, or too short, the degree of discrepancy from the right angle is noted (5 10 15) Each foot is tested in turn and the results tabulated for use in later correction This test is important in that uncorrected heel cord tension may lock the foot in the internal rotatory deviation causing symptoms The clinical evaluation of all of these findings will be considered in the chapter on Individual Correction.

The final step of the foot examination is the preparation of the individual Foot Measurement Chart This is in essence a record of a series of foot measurements required for this different technique of fixed postural shoe correction. Other workers in this field may wonder that this relatively simple procedure is sufficient. It is recognized that many practitioners use more complicated methods, such as foot casts, carbon tracings etc. Casts record only primary deformities much as do preliminary mouth impressions of the orthodontist before corrective measures have been applied. Moreover they accumulate rapidly cannot be made a part of a permanent record, and in general are without useful purpose.

As the prime purpose of this method of correction is to shift weight bearing lines the original faulty position is only a starting point for correction The Foot Chart that contains these measurements requires, for its production, only a blank sheet of paper and a fountain or ball point pen. It will be demonstrated later that from these charts are determined not only the type and size of the varied corrective devices to be used, but their ultimate position in the shoe All data that may influence both tentative and final prescriptions for each individual foot is entered on this chart, providing a permanent reference record. The details by which this series of measurements is made is described in the series of illustrations (Figure 35 [1 10])

Certain salient points must be emphasized. First, the metatarsal heads are located by thumb pressure on the plantar surface of the foot As will later be demonstrated in detail, where there is metatarsal descent and metatarsalgia, this exact point must be located with extreme accuracy by determining the exact point at which thumb pressure produces the greatest straightening effect for the toes If the pressure is made either too far forward or backward there will be little or no effect on the adjoining phalanges When this precise point is located a linear transverse mark is made just in front of the thumb (Figure 35 1) Two longitudinal marks are made at right angles to this, the internal one directed towards the interspace between the large and first small toe, and the external one towards the interspace between the third and fourth small toes (Figure 35 2 and 3) In this manner the anterior portion of the weight bearing tripod, the head of the 1st and 5th metatarsi are demarcated The foot is now placed downward on the chart paper and the mark just made makes its appearance by ink transfer (Figure 35 10)

The next mark is a perpendicular dropped from the posterior end of the internal malleolus (Figure 35 4 and 6) Radiographic studies demonstrate that the posterior edge of the internal tibial malleolus corresponds to the anterior margin of the tuberosity of the calcaneus The heel mark is made at the exact point of skin contact with the chart paper (Figure 35 5) From this point all other measurements are computed Another perpendicular mark is made just back of the head of the 1st metatarsal (Figure 35 7) Now the inside, outside, and front borders of the foot are outlined (Figure 35 8 and 9) The foot chart is a mirror image of each foot as is the upper inner surface of the insole of the shoe. The exact measurements of the size and shape of anterior and long and their respective distances from the heel, constitute a permanent record furnishing information essential to the technique of fixed postural shoe correction

Additional information such as a radiographic difference of leg lengths shortness of heel cords, torsional deformities peculiarities of metatarsal descent etc are entered on the foot chart as supplementary information It will be found that all such information may influence both tentative and final prescriptions for fixed postural shoe corrections

PART IV

TREATMENT

Chapter | *Page*

CHAPTER NINE

The Suitable Shoe—The Reenforcement and Outside Correction

IT HAS BEEN demonstrated that a great variety of symptoms stem from primary postural deviation of the foot, with secondary changes in the superstructure Therefore, postural shoe correction is the most important single step in the reversal of serial distortions The corrected shoe must have sufficient structural strength to continuously block internal rotation of the feet and legs, and this cannot be effected by the measures now commonly used, namely flexible shoes, movable arch supports or by manipulation or exercises alone.

This different approach can be logically divided into two distinct categories The first is concerned with the selection of the suitable shoe, its plastic reenforcement, and subsequent outside correction of the sole and heel The second phase is the individual correction of this specially prepared shoe

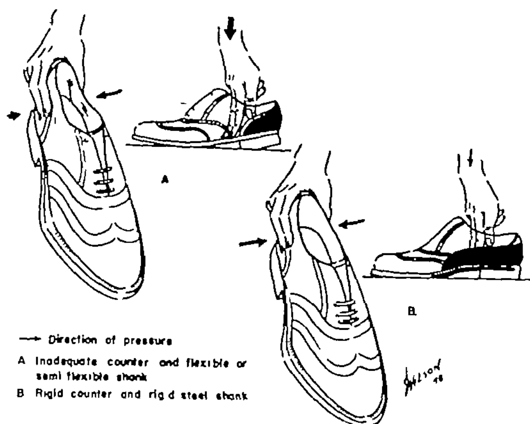
Since no two patients are exactly alike, and all too frequently the legs and feet of the same individual may differ considerably fixed postural shoe correction has come to be highly individualized, not only for the different patients but for the two feet of the same patient. This corrective mechanism has been compared to a chain, the strength of which is determined by its weakest link. Consequently every phase in the series of corrective steps is relatively important.

As a starting point a suitable shoe having sufficient built in structural strength is selected Such shoes must not only be properly fitted, but should have as an integral part of their construction, a rigid steel shank and a long counter It is not pertinent to our considerations to attempt to describe the almost innumerable types of shoe construction. They can be divided into three general classes—flexible, semi flexible, and rigid Since only rigid types can satisfactorily withstand weight bearing stress a technique of recognition is illustrated (Figure 36 A and B) as well as simplified non technical terminology for the use of practitioners interested in the problem of shoe correction (Figure 36 C and D)

Suitable rigid shoes can be described as having two parts a sole and an upper The sole, or weight bearing surface, ordinarily consists of an inner and outer layer between which in the posterior portion, is a reenforcing rigid shank (Figure 36B) The upper segment of the shoe is affixed to the sole and designed to hold the foot in position Similarily it also consists of an inner and outer layer and between these is interposed in its posterior portion, a stiffening device or heel counter In the best types of shoes this is considerably longer on the inside border than it is on the outside, ending just short of the weight bearing portion of the sole (Figure 36B)

Rigidity of the shank and counter reenforcement of any shoe may be tested by the following simple procedures The shoe is placed on a flat surface and downward pressure is made by the extended fingers at a point just in front of the heel. If the shoe buckles in the center and the rear end of heel tilts upward, the shoe is either without a shank or has a flexible or semi flexible inadequate one (Figure 36A) If however extended finger pressure in the same manner and at the same location is withstood without any movement whatsoever of the sole or heel, shank construction can be considered as adequate (Figure 36B)

The strength of the counter must be tested not only for adequacy but for length as well to determine whether this stiffening extends far enough forward on the inside border of the shoe The vast majority of men s and children s shoes are made with short counters automatically forcing elimination of many of these for correction. The greater number of



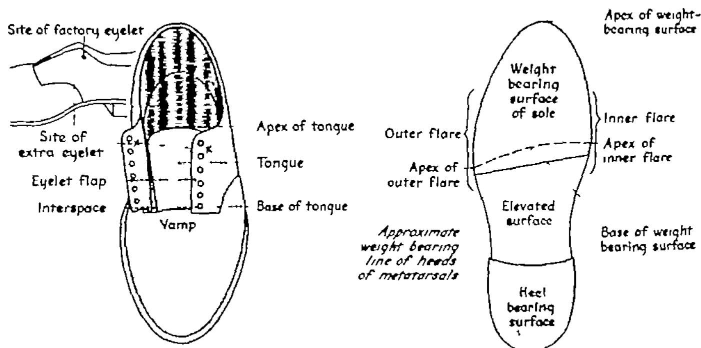


Figure 36. Tests and a Simplified Terminology for the Suitable shoe. A. Test to demonstrate structural weakness in shoes B Tests demonstrating adequate strength in shoes. C. Simplified terminology for the upper " D Simplified terminology for the sole.

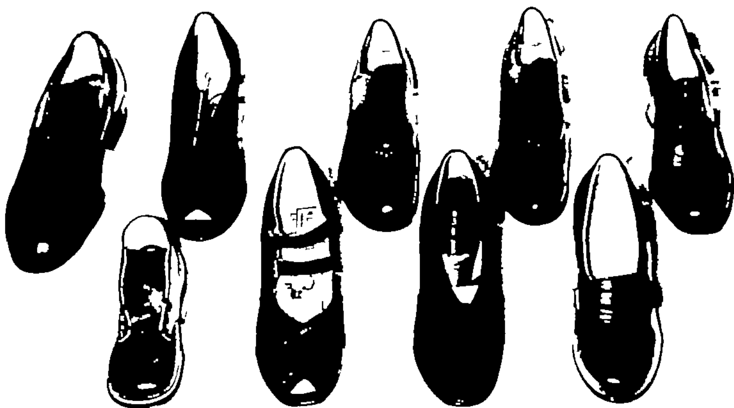


Figure 37 Examples of Suitable Dress and Walking Shoes of All Ages.

women s walking shoes have built in long counters as manufacturers have found that this gives better support and fit to the smaller and more slender female foot.

A number of commercial brands of suitable shoes having long counters and rigid shanks are illustrated (Figure 37) and a list of examples is appended * If certain trade names have not been included, this oversight is not intentional as many of these may be equal or even superior to those listed

Because of its clinical importance one cannot quit the subject of shoes without discussing an extremely important phase—the relation of corrective shoes to the style complexes of women This is understandable particularly since many exponents of shoe correction demand that women wear shoes that bear a distinct resemblance to those worn by school boys A few elderly women made desperate by foot pain may wear this type of shoe but a great number of adult women of all ages will endure the agonies of such pain rather than wear ugly shoes One can sympathize with this attitude as all too frequently such shoes are incongruous with style In the past few years a concerted demand for better styling, aided by the armed services endorsement, has forced many shoe manufacturers to fabricate better looking shoes

In practice it has been found that certain blocks in psychology can be overcome by education. First, the female patient must be warned that she cannot wear high-heeled dress shoes continuously In certain resistant cases one must be satisfied if the individual will wear corrected lower heeled shoes for prolonged weight bearing In a great number of these the relief experienced is sufficient to affect a complete change of attitude In practice it has been found that if a dress shoe is corrected for sitting down purposes at the same time that the patient is given a fully corrected walking shoe many women will consent to the wearing of both Psychologic resistance is lessened if the patient learns that personal appearance is aided by improvement in body posture

Not only must the shoe be of suitable construction, but it must be properly fitted It can be said

* For Men Florsheim (custom long counter type only) I Sabel, Thompson, Smith Syncroflex, Wright Arch Preserver (long counter type only)

For Women Conventional Orthopedic types Miller Foot Defender I Sabel, etc Semi-style and Dress Miller Foot Defender Selby Matrix, Drew etc

For Children I Sabel Child Life Pied Piper etc

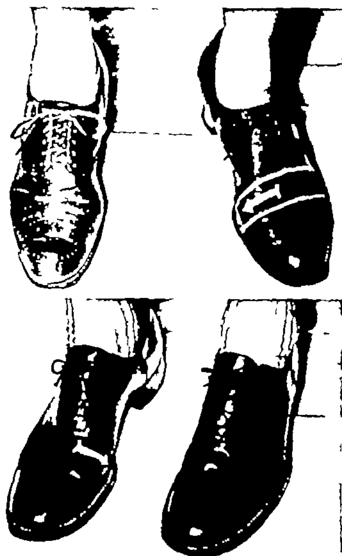


Figure 38. The Fitting of Shoes. A (*Upper*) External evidence of improper fit—"leather loop" pressure. B (*Lower*) External evidence of proper fit.

without fear of contradiction that faulty fit is the rule rather than the exception. Unless the shoe snugly hugs the heel, particularly at its narrowest posterior point rotation cannot be controlled. Errors in width and length however more than any single cause, are productive of the shoe deformities from pressure (bunions, bunionettes, hammer toes callouses, etc.) The prime consideration of fitting should be to note *the position of the 1st metatarsal head* (Arrow Figure 38A) If this is at the same level as the inner flare of the shoe, the widest part of the foot is properly placed to coincide with the widest part of the shoe. If the shoe is too short, the foot will project over the sides of the sole causing a "leather loop" pressure effect. If the head of the 1st metatarsal lies at the exact apex of the inner flare (Figure 36D) at the moment of full weight bearing expansion, the upper will not project over the sole (Figure 38B)

The next succeeding step in the series of correction is the plastic reenforcement of the suitable shoe. It has been demonstrated that in walking each shoe must alternately sustain the full body weight. Tons of weight per mile cannot be contained without structural breakdown even in the best of shoes. In fact this led to the conclusion that shoes were only stiffened leather bags

The recognition of this basic structural weakness led to the technique of plastic reenforcement for all shoes as a structural prerequisite. It is this particular feature, more than any other that differentiates this method of correction from other types Shoe reenforcement was started early in 1947 when it was realized that even the best long countered shoes broke down. An office assistant, having had experience in airplane construction, suggested that additional structural strength might be afforded by addition of plastics However the plastic techniques used in airplanes require high temperatures, obviously unsuited for leather shoes Considerable experimentation has finally resulted in the development of a satisfactory inside counter or shell

There has already been described the stiffening devices, or counters, for the inner posterior border of the upper construction of shoes These are of two types, long and short. Structurally these are completely inadequate to sustain prolonged and endlessly repeated weight bearing thrust of internal rotation With this technique of plastic reenforcement by the addition of the inside counter or shell, the structural strength of the shoe is infinitely increased (Figure 39) In fact, repeated inspection of shoes showing extreme wear revealed that the shell has remained relatively intact. This reenforcement is applied indiscriminately to all shoes approved for corrective purposes. It is therefore not *an individual correction, but a supplementary improvement* to the fabrication of shoes. The actual technique of installation as currently used will be described and illustrated.

A fiberglas cloth has been found to be an indispensable binding agent for the combined plastics *

* Fiberglas cloth—Bolt material—heavier weight type—No. 182 14-38, Mfgr Owens-Corning.

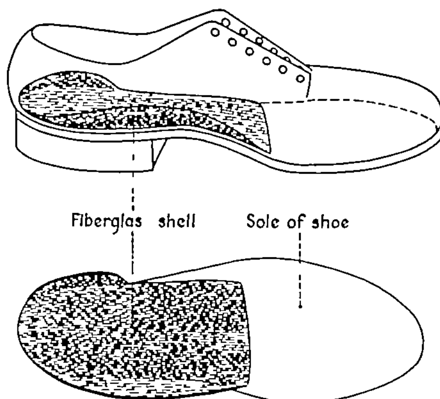


Figure 39 The Fiberglas Shell or Inside Counter

The material used is of the closely woven type resembling heavy glistening white satin The tighter and heavier weaves have been found to be preferable to the lighter weight loosely woven ones which not only tend to fray at the edges but fail to hold the plastic bond. In actual practice the fiberglas material is impregnated in water and by means of an arbor press and stamping dies six sizes of fiberglas, all of the same basic shape, are cut (Figure 40A) This method is decidedly preferable to hand cutting with scissors as fiberglas dust may be exceedingly irritant to the skin of many individuals

A suitable size is selected, one that is slightly larger than the area of the shoe insole and three layers are then stapled together at the front and back ends (Figure 40B) The smooth side of the staple is always placed upward to distinguish the right from the left of each pair after chemical treatment The three layered inserts are then placed in the shoes for sizing and beveling Sizing consists of marking the inside flange border and the outside ear or heel flange with a glass or wax pencil so that they extend about one-half inch above the inner sole of the shoe (Figure 40C) It has been established that the fiberglas insert should not extend further than a point one half inch short of the metatarsophalangeal junction When it is extended beyond this point it eliminates the bend of the shoe at the line connecting the inner and outer flares of the sole, the metatarso-phalangeal junction, causing a wooden shoe effect.

Each stapled three layer insert is removed and trimmed along the line previously marked by the glass or wax pencil. The edges are then beveled by trimming the under and succeeding layers to eliminate terminal ridges (Figure 40D) After this preliminary fitting the chemical plastic compound is prepared the proportions of which are illustrated (Figure 41) The components and properties as developed for this purpose are described by Steinman* as follows

The use of Posturex as an integral part of shoe correction is an adaptation of high strength products as utilized by the aircraft industry The use of glass fiber reinforced plastics has been widely accepted because of its high strength, impact resistance, moisture resistance and dimensional stability for such applications as auto-

* The Thalco Company Steinman, Robert Ph.D Consulting Chemist, 765 So Harvard Boulevard Los Angeles 5 California.

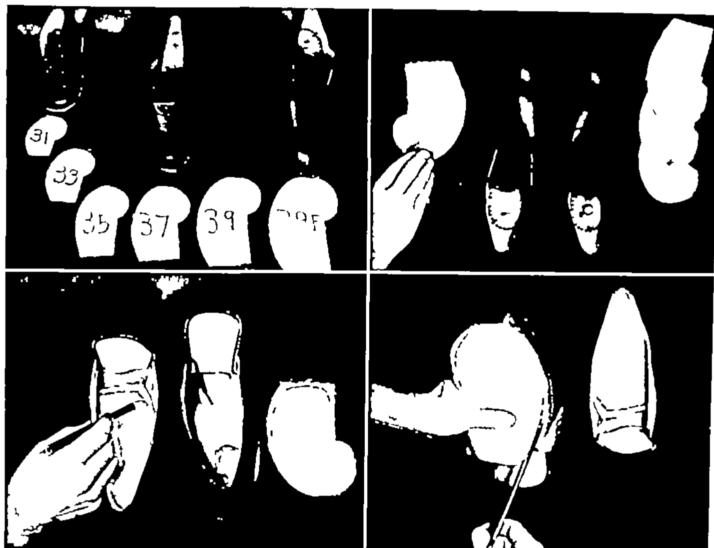


Figure 40 The Fiberglas Base of the Inside Counter (shell) A (*Upper left*) Preliminary assembly of the different sizes of fiberglas inserts. B (*Upper right*) The stapling of the three layered insert. C (*Lower left*) Sizing the insert to the individual shoe. D (*Lower right*) Trimming and beveling the insert.

mobile bodies, boats, fishing rods, furniture and airplane parts

There are three integral parts composing the Posturex system. The Posturex resin (Selectron) is a special formulation of polyester resin. This material contains styrene as a cross linking or thermosetting agent Under the influence of the Garox BZP and Garako 100 the Posturex resin sets up hard and becomes the structural unit. This hardening action changes the Posturex resin from a liquid to a solid. The embedding of the glass fibers in this liquid resin before it hardens imparts the desired strength characteristics to the resin. A common analogy for this process is the reinforcing of concrete with steel bars and wire

The Posturex resin is an alkyd resin based on glycols and unsaturated dibasic acids This alkyd is then dissolved in styrene monomer to produce a useable liquid material. Garako 100 is an accelerator which is added to the resin at the time of its use to accelerate the cure of the resin in combination with the Garox BZP which is a peroxide catalyst. The Garako 100 speeds up the catalytic action of the Garox BZP on the Posturex resin. (A note of caution Garox BZP and Garako 100 should not be mixed together prior to the addition to the Posturex resin This could cause a fire. Each ingredient, that is, the Garako 100 and the Garox BZP must be mixed into the resin separately just prior to use)

Garox BZP is a dispersion of a peroxide in a neutral carrier which facilitates the ease of solution of this catalytic agent in the Posturex resin. Under the influence of the Garako 100 and heat the Garox BZP breaks down into free radicals which in turn react with the active phases of the Posturex resin and hardens the Posturex.

The following table contains typical physical properties of the glass reinforced Posturex structure



Figure 41 The Preparation of the Plastic Chemical Compound.

Flexural Strength (bending)	60 000 psi
Compressive Strength (crushing)	42,000 psi
Tensile Strength (pulling)	45 000 psi
Impact Strength (lbs inches of width)	20
Moisture absorption % (after 24 hrs.)	0 15

The mixture is prepared in a flat cake tin which has been lined with heavy wrapping paper so that the left-over hardened residue may be discarded The basic plastic (Selectron resin) in the desired quantity must be placed in the pan first and then in turn the two catalysts (Garox and Garako) must be added separately and only after each has been thoroughly stirred into the solution. As mentioned by Steinman, they must never be added directly to each other for when so combined they form an explosive compound

The proportion suggested (8 oz Selectron to 1½ tsp of Garox, and 2 tsp of Garako) has been found to be satisfactory in producing an optimum bluish gray compound Slight variation is permissible if necessary Each pair of shoes requires approximately one ounce of the reenforcing plastic

The stapled inserts are immersed for several minutes in the plastic mixture until thoroughly impregnated (Figure 42A) They are then grasped by surgical forceps and hung above the pan to allow excess chemical to drain (Figure 42B) They are placed on paper and turned over as often as necessary to eliminate all excess plastic (Figure 42C) The thoroughly dried, but still flexible insert is folded once, held by the surgical forceps as illustrated, and placed in contact with the upper posterior surface of the insole of the shoe (Figure 42D) It is now moved into optimum position, at the same time brushing away any interposed air bubbles between the insert and the insole Should even a drop of excess plastic be deposited outside the area to be reenforced, it should be removed immediately by a cloth dipped in acetone Unless this is done while the plastic is still pliable, it will form a hardened mass that can only be removed by grinding a hazardous procedure that may cause damage to the inner lining of the shoe

Although this particular fiberglas plastic process

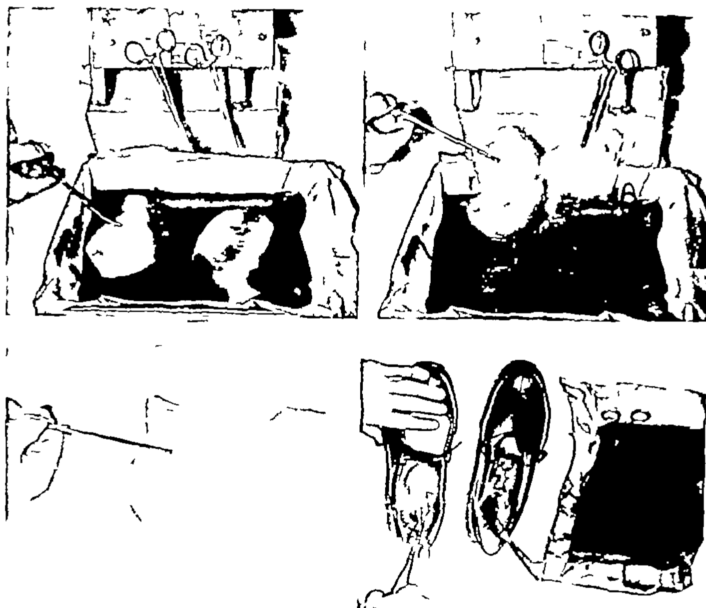


Figure 42 Chemical Treatment of the Shell (Inside Counter) A (*Upper left*) Impregnation of the fiberglas insert. B (*Upper right*) Draining the excess plastic fluid. C (*Lower left*) Drying the plastic insert. D (*Lower right*) Placement of the plastic insert.

is technically a "cold" one it is so only by comparison with others requiring high temperatures Unless the plastic inserts are dried by low heat they will remain sticky for days and cannot be given final processing or grinding. To facilitate the drying process a simple wooden box has been lined with asbestos sheeting and wired for the installation of overhead infra red lamps (125 or 250 watts) (Figure 43A) The shoes containing the moist inserts are placed about two feet beneath the heat lamps with the anterior portions projecting beyond the heat zones The thermometer should not exceed 135 Fahrenheit as greater heat may cause shrinkage or cracking of the leather Ordinarily a two hour heat treatment is sufficient to dry the inserts, the time interval as applied here being controlled by an automatic timer (Minneapolis Honeywell)

During the process of drying, the upper surface of the insert is repainted several times with additional layers of the plastic chemical compound, (Figure 43B) Particular attention is directed toward heavily coating the points where there is a change in direction—the bases of the inner and outer flanges. Reheating is necessary after each painting In the end the fiberglas shell or inner counter must be thoroughly dry and have a "glassy" bluish gray appearance.

The final processing of the dried shell consists



Figure 43 Low Heat Treatment (Cold Techniq
A. The asbestos lined heat cabinet and automatic ti
(Front Panel Removed) B Repainting the drying i



Figure 11 The Final Processing—The Smoothing of Rough Edges. A. Power driven (Hol gun) specially designed burr B Grinding the edge of the outer heel flange C Grinding the edge of the inner long arch flange D Removal of fiberglas dust by suction.

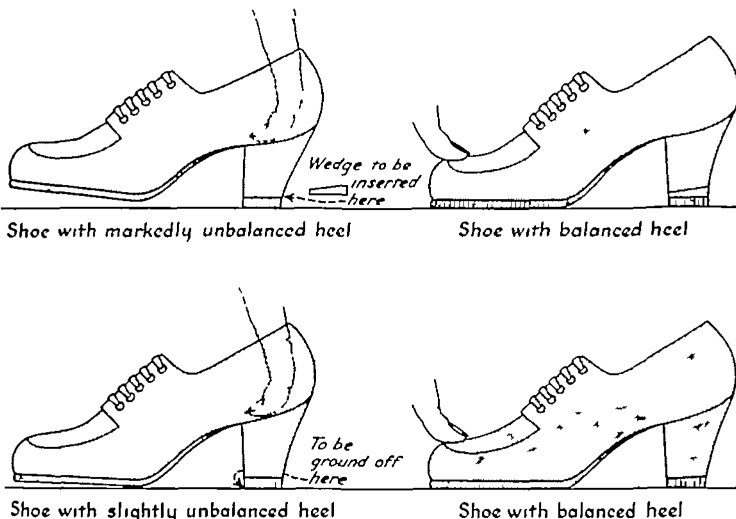


Figure 45 The Recognition and Correction of Antero-Posterior Shoe Instability (Unbalanced Heels)

in smoothing the rough edges For this purpose power is furnished by a Black and Decker ball bearing holgun (Figure 44A) From experience this heavy duty type has been found to be vastly superior to the ordinary small household bronze-bearing types The grinding operation, formerly a tedious process has been facilitated by two modifications First, the revolutions per minute have been increased from the standard 23 24 hundred to 34 36 hundred, and second, a special cone-shaped burr head has been designed having a long shank permitting use in forward points inside the shoe * The saw-toothed front and smooth base of the grinding head prevents scuffing of the inside lining of the shoe from inadvertent contacts Starting at any given point, the circumferential borders of the insert are ground until there are no rough edges (Figure 44B)

* Long shanked grinding burr (Severance)—Special design Postural Company 439 No Bedford Ave Beverly Hills, California.

Particular attention must be paid to the outer heel flange as any residual roughness may cause irritation (Figure 44C)

Finally the powder that accumulates from the grinding of the edges is removed by vacuum suction (Figure 44D)

Once the suitable shoe has been reenforced it must be tested to eliminate built in or factory instability For quite naturally rotatory deviation can not be blocked by a shoe which rocks fore and aft, or from side to side A technique for determining these defects and their correction is illustrated (Figure 45) This figure is particularly concerned with antero-posterior rocking or instability but lateral instability is determined in exactly the same manner by rocking the shoe from side to side The shoemaker is instructed to correct gross inequality by inserts and minor defects by grinding Three different types of wedging corrections are applied in this specialized technique, namely inside, outside, or

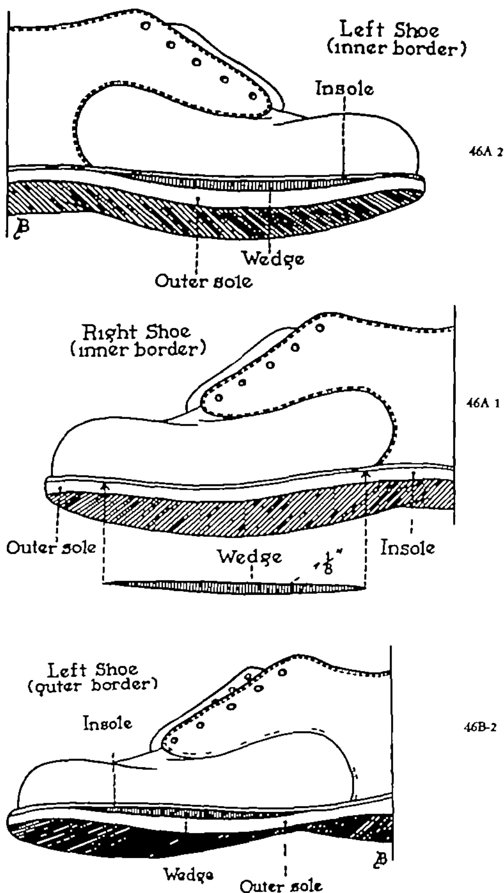
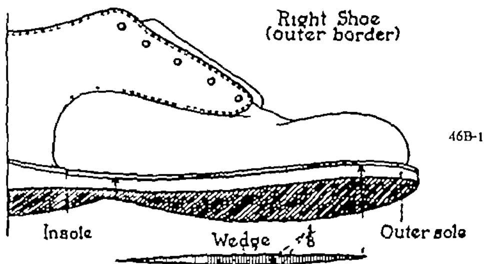
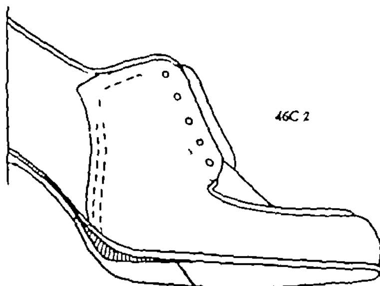


Figure 46 Certain common types of outside shoe corrections. A 1 The inside wedge before placement. A 2. The inside wedge *in situ* B-2. The outside wegde *in situ*





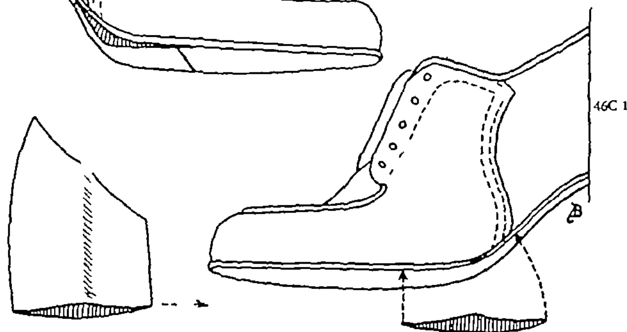
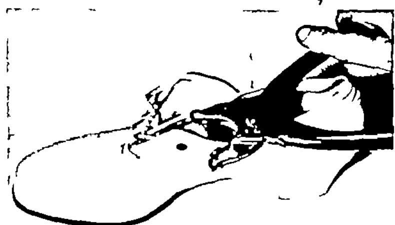


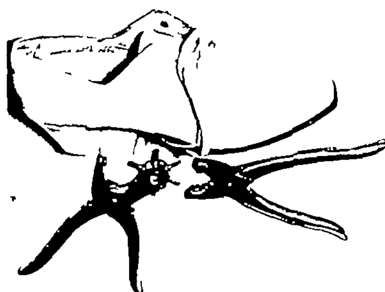
Figure 46. Certain common types of outside shoe corrections (*cont*) B-1 The outside wedge before placement The beveled metatarsal wedge *in situ* C 1 The shape of the beveled metatarsal bar before placement.



46-D



46-E



46-F

Figure 46 Certain common types of outside shoe corrections (*con t*) D Optimum position for the extra eyelet—opening by leather punch—eyelet and clamp below E. Closure of eyelet using cobbler s clamp F Inside surface of closed eyelet *in situ*

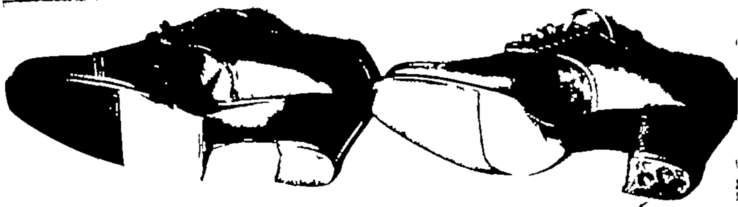


Figure 47 Unsightly Metatarsal Bars Left—Thomas anterior heel Right—Hauser comma bar

central (metatarsal) wedges The clinical indications for each can be summarized in outline form as follows Inside wedging (Figure 46A¹ and A) as an aid in

1 Correction of all types of internal rotation of the feet and legs except those of minor degree
2 Correction of outtoeing
3 Correction of inflammatory condition on the inside border of the foot (bunions etc.)
4 Correction of internal torsional deformities (knock knees)

Outside wedging (Figure 46B¹ and B²) as an aid in the

1 Elimination of the over-correction found in slight degrees of internal roll
2 Correction of intoeing
3 Relief of irritative condition on the outside border of the foot (bunionettes etc)
4 Correction of external torsional deformities (Bow legs)

Metatarsal wedging (Figure 46C¹ and C²) as an indispensable aid to the relief of

1 Metatarsalgia and toe flexion contracture

Before describing each of these procedures attention is called to the fact that the outside sole correction used for intoeing or outtoeing is by seeming opposites Intoeing requires external wedging, whereas the opposite mechanism outtoeing is aided by internal wedging

The illustrations (Figure 46 A¹ and A² and B¹ and B²) depict the size and placement of wedges as they are inserted between the layers of the sole. It is our opinion that there are certain common errors in the wedging of shoes such as gluing them to the outside of the shoe, or covering too small an area In both of these instances there is either a failure or rapid loss of correction The recommendation for sole wedging in the great number of patients that have inflammatory conditions on either the internal or external borders of the feet (internal bunions external bunionettes etc.) can be briefly summarized in that all exotoses are benefited by shifting weight and shoe pressure away from the inflammed area

It should be recognized that external wedging tends to throw the foot into internal rotation and therefore additional compensatory correction must be used inside the shoe to overcome this particular thrust. It is also used in all cases in which rotation is slight, or where it is needed to combat the effects of over-correction. In this particular technique external wedging is used only occasionally whereas internal wedging is almost a routine procedure *This constitutes a radical departure from detorsional techniques (Lewin Hauser etc) who regularly prescribe as a routine procedure the combination of the external wedging to the sole with internal wedging of the heel It is believed that this practice when combined with the recommended flexible shoes almost invariably locks the foot and leg in an internally rotated position the one that is the cause of the varied distant neuralgias This might be the reason that practitioners using this method of correction seldom report relief of low back pain sciatica or upper root neuralgias from foot correction*

An outside shoe corrective technique frequently

used is illustrated in Figure 46C[1] and C[2] namely the beveled metatarsal bar This differs radically and has been found to be infinitely superior in certain respects to other unsightly types usually recommended [Thomas bars, anterior heels, comma bars (Hauser) etc.] (Figure 47) The beveled metatarsal bar used in this technique is practically invisible. It is fashioned from sole leather approximately 1/4 inch thick at its center portion, and beveled to a paper thinness at both anterior and posterior borders This is fitted to a point just back of the break on the sole of the shoe, viz., slightly posterior to the metatarsophalangeal line, glued and fixed into position by clamps By weight transfer metatarsal pain is relieved. Although originally reserved for the more resistant cases it has been so effective that it is now prescribed for practically all cases having metatarsal pain at any point Since this is frequently an exceedingly refractory condition, the aid furnished by this device has been of inestimable value.

Raising the inside border of the heel (Thomas heels) is never used in this particular fixed postural technique. Instead, great emphasis is placed on keeping the external heel surface level to eliminate instability at this very important point. Even when the heel is not wedged internally the tendency for the heels to run over must be continuously checked by heel cap replacement, as otherwise the shoe may be completely thrown out of line. This is aggravated in all shoes in which the heels have considerable height (women s shoes cowboy and engineer boots, etc.) Heel tilting without shoe distortion can be affected by the use of internal sponge rubber beveled heel seats

The final point in the outside correction of shoes consists in insuring that the foot is held snugly on the prescribed inside shoe correction To secure snug ankle fit by adequate lacing, extra eyelets are installed between the upper and the next succeeding lower eyelet (Figure 46, D-E F) rather than above the last eyelet as is factory custom (Figure 36C) The factory eyelet position is most unsatisfactory as it causes the top-most lace to strike the unprotected dorsum of the foot. An additional feature aiding snug fit is secured by padding the tongue with an adhesive-backed felt insert. Its use is regularly prescribed as snug lacing may irritate the unpadded skin that covers the bony dorsum of the foot.

The use of the extra eyelets usually means that the laces supplied with the shoe may be too short by a matter of 8 to 10 inches Therefore, rolls of lacing material and tips are secured in popular shades from firms specializing in cobbler supplies.

The suitable shoe having been carefully selected reenforced and given certain specific outside corrections as described in this chapter is now ready for the next link in the corrective chain namely the individualized inside adjustment of the shoe

CHAPTER TEN

The Individual Inside Adjustment of the Suitable Reenforced Shoe

THE FINAL fixed postural shoe correction has come to be highly individualized it not only differs considerably for each patient, but quite frequently is not the same for the two feet of the same patient. The choice of the suitable shoe and its reenforcement is a routine procedure applied indiscriminately to all shoes for corrective purposes The inside and outside shoe adjustments however are individual ones determined by the findings of examination

The statement has been made that this technique differs considerably from any that have been previously described A comparative survey would therefore require a brief summary of the present unsatisfactory situation before these differences can be evaluated While medical science has made unparalleled progress in the past thirty years the situation regarding the problems associated with the correction of foot posture, has not changed one iota. There is today the same diversity of opinion, one school of thought endorsing arch supports of varied types while another group is unalterably opposed to any type of corrective support and place their reliance on nonrigid shoes, exercises and manipulations With rare exceptions aside from this fixation of theoretical opinion in actual practice the entire problem as it concerns medical practitioners has been relegated to the chiropodists and arch makers In the end millions of chronic sufferers wander in a great circle vainly seeking relief

In practice, with the growth of knowledge, al

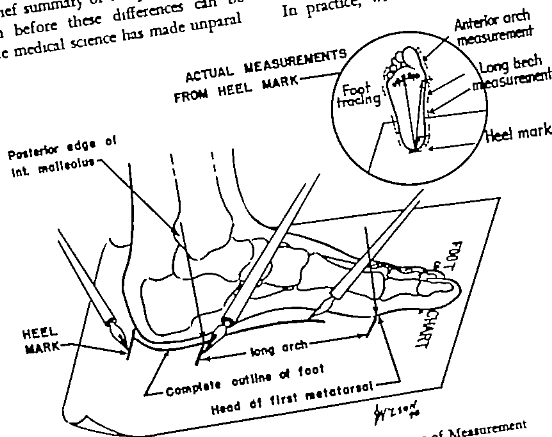


Figure 48 The Foot Chart—Summarized Technique of Measurement

SHOELACES

EYELETS			INSOLE COVERS						BEVELED HEEL SEATS			
			Children's			Women's	Men's					
White	Black	Brown	Small	Medium	Large		Medium	Large	1	3	5	7
TONGUE PADS		OUTSIDE HEEL FLANGE COVERS				LONG ARCH CORRECTIVE DEVICES						
Small	Large	Small	Medium	Large	11	12	L14	R14	L15	R15	L16	R16
SHOELACE TIPS			SHOE STRETCHERS				ANTERIOR ARCH CORRECTIVE DEVICES					
White	Black	Brown					21	22	23	25	26	27

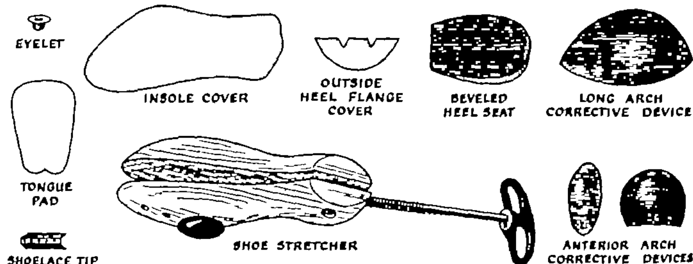


Figure 49 Armamentarium—Materials and Tools Used for Individualized Inside Correction of Shoes.

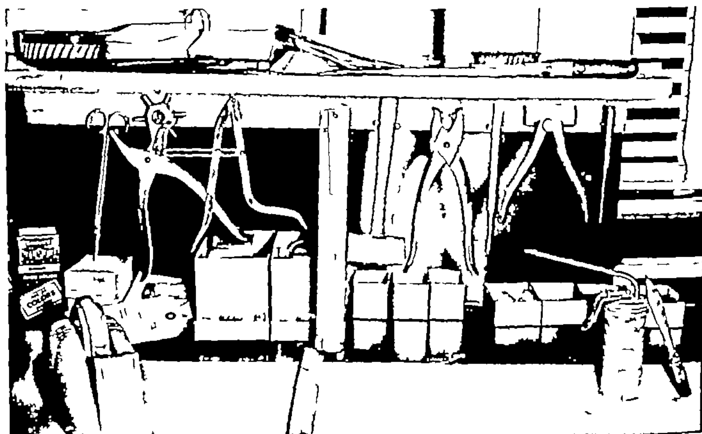


Figure 50 Fabricating Tools Left to right—Curved scissors, leather eyelet punch, shoe caliper 4 and 12 inch ruler, hammer eyelet lamp cotter key puller for removing glued devices, closure clamp for shoe lace tips, punch for smoothing rough inner surface of eyelet, automotive lubrication can used as container for rubber cement, stubby brush applicator

though foot pain is a considerable problem, we are not nearly as concerned with this symptom alone as was formerly the case In fact, by far the greater number of patients complaining of distant and varied neuralgias may be completely without foot pain Once this was realized, the prime purpose now is the correction of internal rotation of the foot, the trigger mechanism, as a means of correcting the serial distortion that causes symptoms at single or multiple levels In the final portion of the postural examination (Chapter Eight) there was described the detailed preparation of a foot chart Because of its importance this has been reproduced in summary (Figure 48) As will be seen this is not only a record of significant foot measurements but positive information is added determining both the tentative (first) and final prescriptions

Once the foot measurements have been made by means of the foot chart, the reenforced shoe is now ready for individual correction. The equipment necessary to effect this is shown in the accompanying illustration and photographs (Figures 49 50 and 51) In Figure 49 examples are shown of the list of materials needed to correct any shoe, from the smallest child to the largest adult In actual practice, pigeon holes were constructed to contain the varied devices and materials In the accompanying photograph (Figure 50) the simple inexpensive tools needed for fabrication are shown * Finally (Figure 51) a slow-speed motor (1400 R.P.M.) and emery wheel is shown, attached to the work bench A metal hood is placed over the emery wheel to catch the rubber dust that results from grinding devices Below is a suction trap and vacuum cleaner The lighter hose is the suction, while the darker hose attached to the top of the tank delivers air pressure.

The final correction of foot imbalance is affected by a series of prefabricated resilient sponge rubber devices (Figure 52) The best consistency is one neither too hard nor too soft. The present series are especially designed for the use in plastically reenforced shoes and are quite thin They differ radically from other thicker types used for the fabrication of removable arch supports that require extensive grinding Because of this basic thinness they can be combined or "built up" into the numerous combinations dictated by the definite findings of examination. *The elimination of the variable factor of grinding has made simple the duplication of correctional prescriptions*

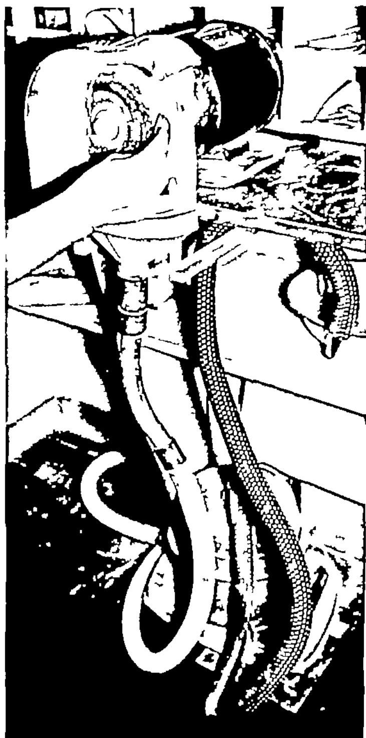


Figure 51 Motor Assembly Slow speed motor and grinding emery wheel, suction trap and vacuum cleaner

* All the instruments illustrated in Figure 50 can be purchased from hardware stores and firms specializing in shoe maker supplies. The sole exception is the specially designed shoe calliper which can be purchased only from The Postural Company 439 No Bedford, Beverly Hills, California.

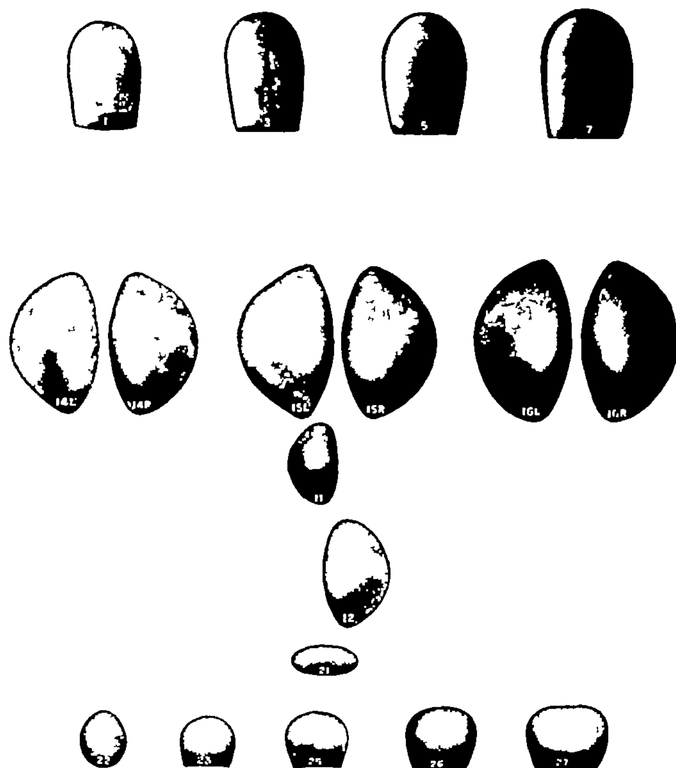


Figure 52 The Three Types and Sizes of Sponge Rubber Inserts. Beveled heel seats—1 3 5 7 Long arch supports—14 L & R, 15 L & R, 16 L & R. Long arch adapters and children's long arch supports, 11 12 Anterior arch supports, 23 25 26 2 Anterior arch adapters, 21 22. (Corrective devices are quite different from those used in the fabrication of removable arch supports

These sponge rubber devices * are of three distinctly different classes 1 beveled heel seats 2 long arch supports and their adapters and 3 anterior arch supports and their adapters each designed for a specific and different purpose. The beveled heel seats and long arch supports correct the primary trigger mechanism, the internal rotation of the foot The beveled heel seat with its thicker internal border tilts the calcaneus or heel bone outward and consequently the entire foot. The long arch support performs the same function by applying upward pressure to the inner border of the plantar surface of the foot. The anterior arch supports have an entirely different purpose, being designed solely to elevate the heads of the 2nd, 3rd and 4th metatarsi (Figure 53) The principles that guide the function and placement of these devices can be understood by a study of this diagram.

Each device and class have been given serial identification numbers that facilitates the writing of corrective prescriptions The first division, or heel seat series, are numbered 1 3 5 7 (the range from 1 10) the second division, or long arch devices and their adapters are numbered 11 12 14L, 14R, 15L, 15R, 16L, 16R (the range from 11 20) and the third division, or anterior arch support series and their adapters are numbered 21 22 23 25 26 27 (the range from 21 30) (see Figure 52)

Only the larger of the long arch supports 14's 15's, and 16's are differentiated for rights and lefts All of the other devices are interchangeable in that they can be used for either foot The reason for this difference has been previously described in that the highest point of the long arch, the talo-navicular junction (Figure 53 Medial view) is not in the middle of the foot, but is eccentrically placed at the junction of the posterior and middle thirds of the long arch measurement. In addition to being too thick, the interchangeable type of long arch support differs by having its highest point erroneously in the middle.

The actual selection and manner of placement of these devices is dictated entirely by the foot chart measurements The first preliminary or tentative correction is designedly a partial or under-corrected one for experience has taught us that an immediate full correction may produce intense aggravation of local or distant symptoms In short, fixed postural shoe correction must be attained by easy stages In the middle aged or elderly patient, or in any patient where there is precedent inflammation the preliminary correction should be worn unchanged for a period of several weeks or at least until the symptoms of initial aggravation have abated

The foot measurement chart as prepared is actually a mirror image of the plantar surface of each foot, as is the inner upper surface of the sole of the shoe For this reason measurements can be transferred directly from the foot chart to the shoe. The focal point is the heel mark at the posterior end The length of the long arch as well as the width of the anterior arch are depicted on the foot chart with their respective distances from the heel mark.

Let us take the foot chart of Mr J A Smith (Figure 54) as an example. This patient had as his chief complaints two extremely painful feet, movable leg pains, and chronic low back pain X ray examination revealed left leg to be one half inch short as compared to the right. Foot examination revealed marked metatarsal descent, toe flexion contractures with localized pain on pressure over the 2nd 3rd, and 4th metatarsal heads

The preliminary or tentative prescription made on 2/28/53 was as follows For the difference in leg length and outside shoe correction a one-quarter inch left heel raise To aid in the correction of severe internal roll on the left foot, the inner border of the sole was raised one-eighth inch. Both heels and soles were balanced. For preliminary inside shoe correction the following devices were prescribed a number 7 beveled heel seat, a 16 R and L long arch support and a 25 anterior arch support. The selection of the size of the particular devices was determined by placing them on the foot chart

The two shoes and the devices selected are placed beside the respective foot chart as illustrated in (Figure 55) a procedure termed the layout For purpose of illustration let us take the right shoe as an example of a tentative (first) prescription, and the left shoe as a final or permanent one Here, in the case of Mr Smith, since the right inward roll was slight, the tentative prescription became the permanent one. Routinely the first device selected for lay

* The Postural Company 439 N Bedford Drive, Beverly Hills, California.

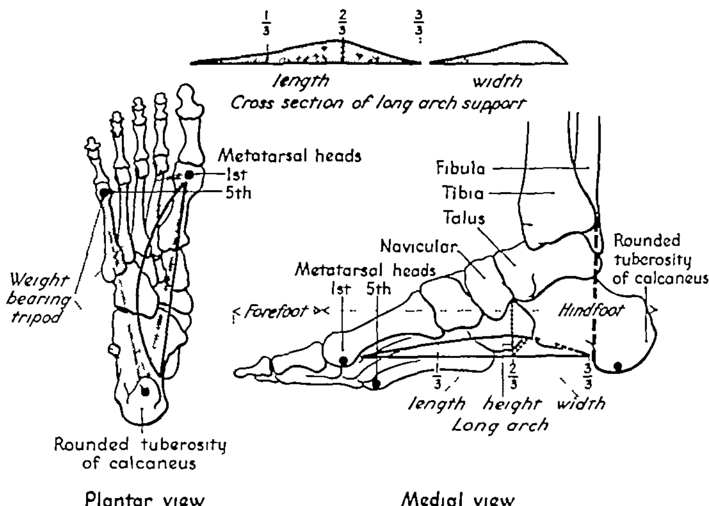


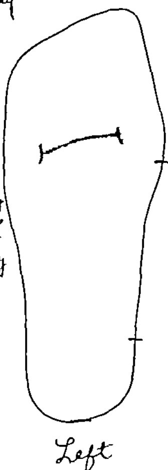
Figure 53 Skeletal Structure of the Foot—Plantar and Medial Views. The relation of corrective support areas to the weight bearing tripod.

out is the notched leatheroid insert (Figure 55-1) of a size adequate to cover the outer heel flange of the plastic shell A beveled heel seat of appropriate size was selected to fill the heel segments of the foot chart, in this instance a number 7 From the three adult right long arch supports the number 16 was found to be of approximately the same length as the measurement shown on the foot chart. For an anterior arch support, the number 25 was found to be of the same width as that shown on the foot chart Finally a leatheroid arch cover was selected and trimmed to adequately cover the inside surface of the corrected shoe (Figure 55 right)

Once the layout assembly has been completed the shoe is ready to be marked for device placement (Figure 56) With a shoe caliper, the length from the heel to the anterior arch line is measured and the nut tightened on the central bar This measurement is then transferred to the insole of the shoe by scratch mark in the manner depicted. Similarly the distance from the posterior end of the long arch to the heel mark is measured with a short 3 to 6 inch ruler This measurement is likewise transferred to the inside of the shoe and marked on its inside border with a ball point pen. The use of the especially designed caliper has considerably facilitated the process of anterior arch placement

We are now ready for the final placement of the devices and their covers All are turned over and, with the use of an automotive pressure lubricating can and a stubby brush, rubber cement is applied to both the undersurfaces of the devices and the upper or inside surface of the shoes The cement, preferably of synthetic rubber must be allowed to dry until it becomes sticky or tacky This process of quick drying can be hastened by the use of the compressed air hose of the vacuum cleaner

The series of steps in the placement of the component parts that comprise both tentative and re-



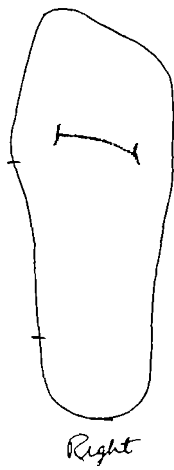


Figure 54. Illustrative Foot Chart.

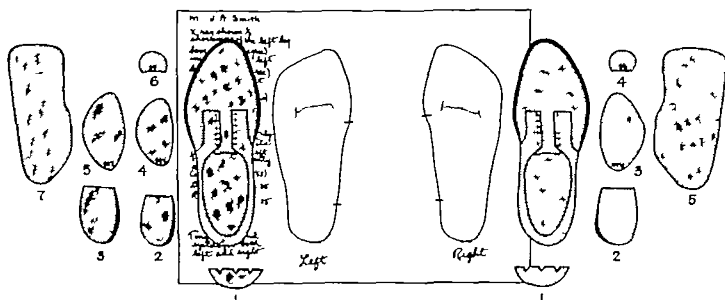


Figure 55. The Layout—The Assembly of Materials as Indicated by the Foot Chart for the Individualized Inside Correction.

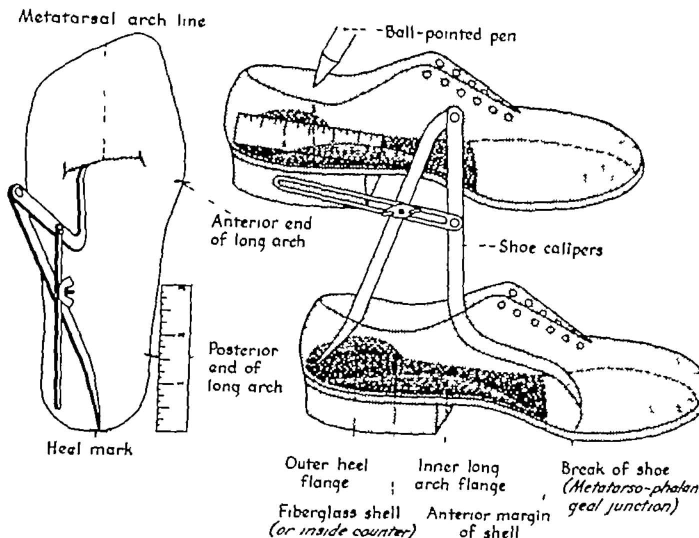


Figure 56. The Technique of Preliminary Measurement.

vised postural shoe corrections in single or multiple combinations are adequately illustrated in the succeeding set of figures (Figure 57 57A to F) Attention should be called to the important techniques of modification. In respect to the long arches, one cardinal principle should be kept continuously in mind, namely that once the overall length is determined the highest point—the talonavicular junction, lies exactly at the junction of the posterior and middle thirds In fabricating the dies for moulding the sponge rubber long arch supports, the highest point lies at exactly the same point, viz. the junction of the posterior and middle thirds.

To accommodate the different sizes of feet, the long arch numbers differ by approximately one-half inch, viz the number 15 is one-half inch shorter than the number 16 the number 14 is one-half inch shorter than the number 15 Therefore, the number 14 is one inch shorter than the number 16 To combine two long arch supports of different lengths take one-third of the length differential from the posterior point of placement for the shorter arch support, and the high points of each will coincide exactly (Figure 58)

An extremely important point of modification is concerned with the placement of anterior arch supports Although there is considerable margin for error in the placement of long arch supports, the relief of symptoms in the anterior arch requires exact placement of supports The anterior arch localization as determined by the ordinary foot chart (ink transfer) may not localize with sufficient exactitude the point of optimum support. For if it is too far forward by as little as one sixteenth of an inch, it will actually increase foot pain by pressure on irritated structures If on the other hand, the anterior arch is slightly in back of the proper position, centralized pain will continue from a lack of elevation

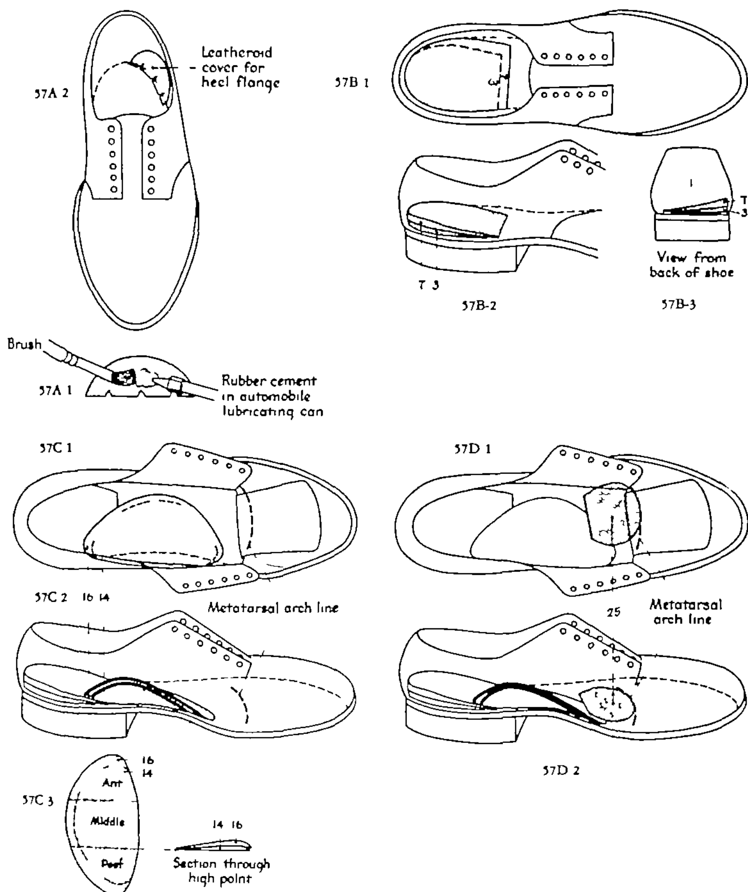


Figure 57 The Technique and Routine Order of Device Placement A 1 Application of rubber cement to leatheroid cover for outer heel flange A 2 The leatheroid cover *in situ* B-1 Doubled beveled heel seats (rubber) *in situ*—superior view B-2. Same devices as in B-1—lateral view B 3 Same devices as in B-1 and B-2—posterior view C 1 Combined doubled long arch supports *in situ*—superior view C 2 Same devices as in C 1—lateral view C 3 Same devices as in C 1 and C 2 before placement with cross section through highest point. D-1 Anterior arch support (rubber) *in situ*—superior view D 2 Same device as in D 1—lateral view

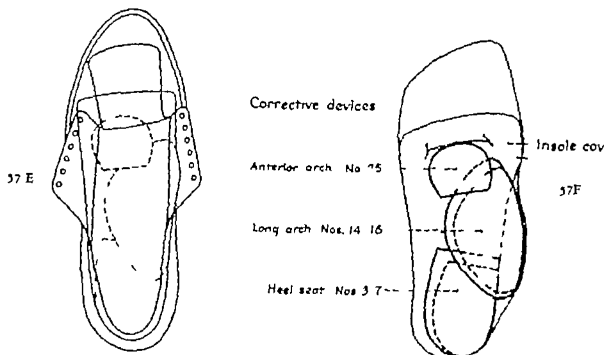


Figure 57 The Technique and Routine Order of Device Placement (*cont*) E—Single set of devices (ur long and anterior arch support) covered by leatheroid insole—superior view F—Doubled heel seats and l ports with single anterior arch support covered by leatheroid insole—superior view

The actual technique is illustrated in Figure 59 A and B Direct thumb pressure is made over the central metatarsal region. If pressure is made in front of or behind this exact point there is little or no movement of the toes. Between the forward and backward position there is one fine point that causes a maximum straightening of the 1st, 2nd and 3rd small toes This point is marked witl pen By means of a ruler used in the m in Figure 59B the exact measurement i

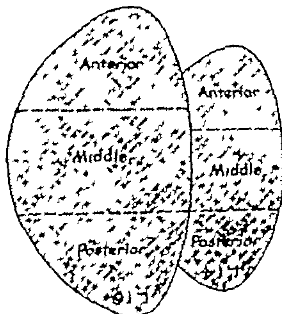


Figure 58. Rules for Placement of Combined Different Long Arch Supports to Give Increased Height.

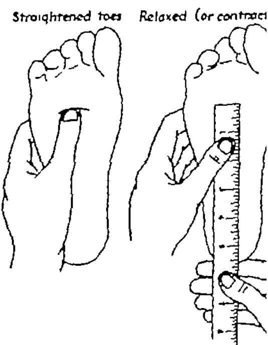


Figure 59 Simplified Technique for Check Arch Measurement. A. Determination of op by thumb pressure B Technique for exact m ment

this point to the heel—in this case the line on the ruler between the index finger and the heel (5⅝ inches) Transferring this measurement to a fixed caliper position the original position is checked If it is too far forward it is moved back, and if short of the optimum position, it is moved forward In many cases relief may not occur until the height of the anterior arch is increased by placing an adapter beneath it, (21 22) This predominately female complaint may not be relieved until the beveled metatarsal bar is added to the outside sole correction

In the event that there is a continuation of recurrence of symptoms tests should be made to determine if there is incomplete correction or a sag in correction from wear The test is in reality quite simple—it must actually correct the malposition of each individual foot. This is based on the General Bimanual Rotatory test, originally described to determine the degree of internal rotation of each leg By manual rotation of the leg at the knee the deviation from straight line weight bearing can be determined in shoes quite as effectively as without them (Figure 60)

If symptoms persist after correction, and the examination reveals that it is incomplete, then it must be revised upwards This may involve a single adjustment or multiple ones If the inner borders of the shoes have not been raised this may be added Heel seats and long arches may be doubled In short, correction is increased by any and all means available

In the end the closer one approaches full correction, the more one is likely to attain symptomatic relief Fortunately many cases may get symptomatic relief at a point far short of full correction In others in so-called hair trigger cases a slight under-correction or sag in correction from wear may either cause continuance or recurrence of symptoms Ordinarily recurrences are more promptly relieved

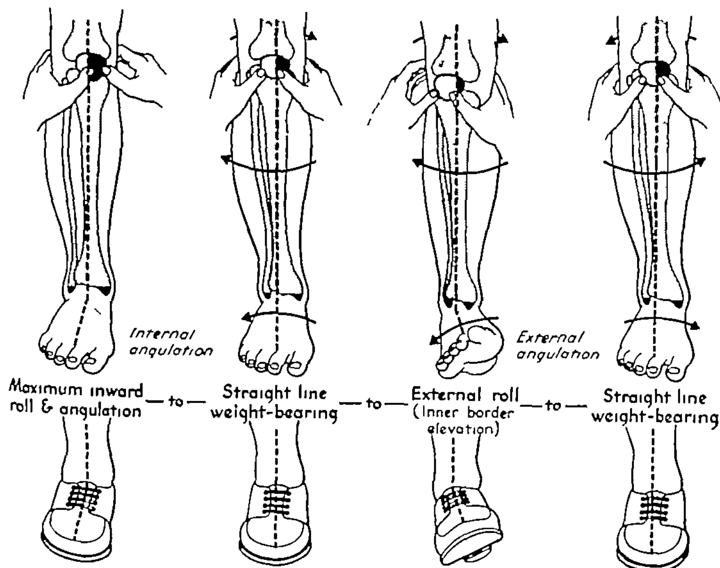


Figure 60 The General Bimanual Rotatory Test (Standing) for Determination of the Degree of Correction in Shoes.

than the original symptoms in that they are not usually complicated by secondary inflammation.

If substantial benefit has been obtained by partial correction, one should hesitate to increase it Not infrequently full correction may upset a fine balance and cause a distinct aggravation On the other hand as has been mentioned, there are patients who must be almost or fully corrected before they secure relief from their varied complaints (Figure 61)

The technique of individualized fixed postural shoe correction has been described in considerable detail in this and the preceding chapter By these varied measures the shoe is transformed into a brace having sufficient structural strength to endlessly block tremendous weight stresses that provoke internal rotation of the foot—the primary cause of serial distortion and a great multiplicity of symptoms

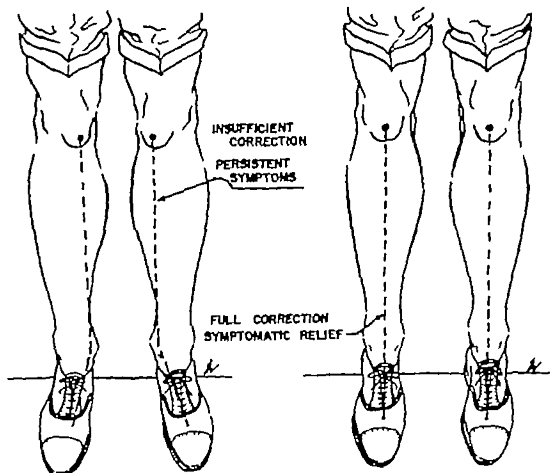


Figure 61 The Relation of Symptoms to the Degree of Correction.

CHAPTER ELEVEN

The Adjuvant Therapy

THE TERM adjuvant therapy may be applied to any type that is used for the relief of certain specific symptoms One of the most important of these is the relief of intense muscle spasms and pain at single or multiple levels This may be of such severity as to make weight bearing impossible and corrected shoes cannot be expected to give benefit until this condition has been at least partially relieved Treatment by prolonged bed rest and the liberal use of sedatives has in the past failed to give more than slight temporary relief to many of these cases A special procedure, a modified balanced or Russell Traction, has been most effective in giving substantial benefit and even complete relief in relatively short periods of time. No originality is claimed for the use of this standard procedure originally designed for the treatment of lower extremity fractures However it has been so largely modified that it is necessary to describe in detail the somewhat different technique of procedure

This routine approach for spasmodic pain is applied indiscriminately regardless of pain levels whether they be in the neck, or as is more frequently the case, in the lumbar or sciatic zones With the growing appreciation of its effectiveness indications for its use have been enlarged to include cases found to be refractory to the ordinary procedures of fixed postural shoe correction, physiotherapy and appropriate medication The basis for its use is as follows

The postural mechanism producing peripheral root and spinal cord tension has been previously described. In a small percentage of cases a vicious circle is formed in which tension produces spasm, and spasm in turn produces more tension This condition is manifested in patients having a sciatic list This symptom can be diagnosed at a distance of fifty paces by simple observation Assuming for example that the left lower spinal segment (lumbar and sciatic) is affected, the patient will stand with the greater portion of the weight borne on the fully extended right leg The affected left leg will be flexed at hip knee, and ankle, with the weight largely borne on the toes To complete the picture of universal flexion to relieve nerve tension from top to bottom, the spine also will be flexed and tilted by side bending towards the affected side.

What is the ordinary treatment given for this symptomatic complex? The patient is put to bed, adhesive is applied to one or both completely extended legs and weights are applied to one or both legs *in extension* In a recent case 35 pounds of weight has been applied to each leg, an amount sufficient to literally pull the patient out of bed With lesser weights increased pain may be controlled by use of sedatives, but all too frequently the physician returns the next day to find that the patient has without authorization, removed the traction to get relief from intolerable aggravation

Similarly head traction, another type of traction in extension, most frequently causes aggravation of upper root pains Many physicians, schooled by experience, have learned to recommend intermittent rather than continuous traction, finding that this is better tolerated The relatively infrequent relief of symptoms from traction in extension may correspond in a way to the sensations experienced when a tight shoe is removed

Conversely bilateral balanced (Russell) traction, or traction in flexion (Figure 62) relieves pain by placing the patient in the position already found to give substantial relief The spine is flexed as well as both lower extremities at the hip and knee joints Intermittent traction has been found to be superior to the continuous variety as it lessens fatigue from long continued maintenance in one position. Ordinarily it is on two hours off two hours, with the patient sleeping out of traction The present routine is to apply this for a five day period, followed by a

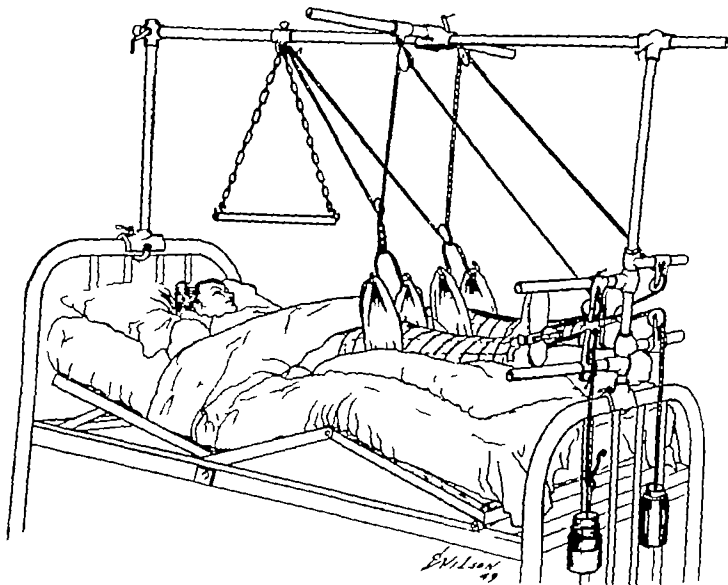


Figure 62. Modified Bilateral Balanced or Russell Traction (in Flexion) for Intractable Pain and Muscle Spasm.

five day resting period, and then reapplied for a second five day period if there is a continuance of symptoms In the greater number of cases two courses of treatment have been found to be sufficient to relieve continuous muscle spasm. This acts as a therapeutic test differentiating symptoms arising from postural imbalance from other causes

TECHNIQUE OF APPLICATION

The armamentarium which considerably facilitates this procedure consists of the following (Figure 62)

An ordinary hospital bed, a single jointed longitudinal overhead arm attached to the bed, six separate short attached transverse arms two knee slings with separating yokes, Pusey foot plates, separate pullies, venetian blind cords and two 7 to 9 lb. weights, and overhead trapeze.*

The lateral surface of both legs are shaved from the ankles to the knees. The skin surface is painted heavily with compound tincture of Benzoin. Four 2 to 3 inch strips of mole skin adhesive are cut to extend from below the knees to a point one and one-half inches beyond the sole of the foot. The lower end is folded, with the adhesive surface inside, to make a strap of triple thickness.

Short sox are applied to the feet and pulled up to cover the bony prominences of the malleoli The straps are now applied to the lateral painted surface of the legs and fixed in place with roller elastic bandages. The lower end of the mole skin strap is now pulled through the buckles on each side of the foot plate and these are

* Gilbert Hyde-Chick, San Francisco, California, #21 75th Ave Oakland, California.

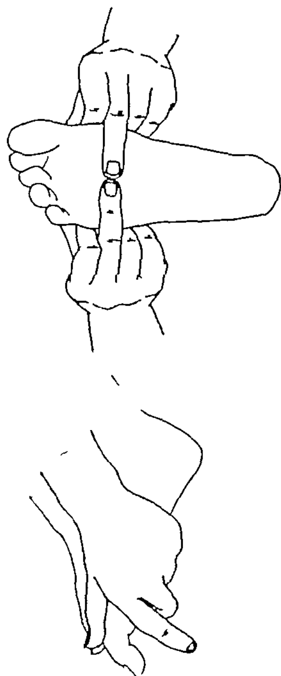


Figure 63 Manipulative Procedure for Metatarso-Phalangeal Fixation A. Position of middle fingers on plantar surface of foot. B Actual technique for reduction of toe flexion contracture.

tightened so that the plantar surface of the foot rests firmly on the plate. The thin venetian blind cords run easily through the pullies and are first attached to the longitudinal arm of the frame above the trapeze and run from this point on as illustrated

The weights are light when compared to those often prescribed varying from 7 lbs. (women) to 9 lbs. (males) Traction is always applied bilaterally to give maximum backward pelvic tilt. The thighs and knees are flexed and supported throughout their entire length on pillows or by raising the foot of the bed where this is mechanically possible If the leg is not supported firmly any movement in the early stages will cause aggravation

To release the patient from traction for the two hour rest periods, the weights are detached and placed on the floor the traction straps released from the foot plates, and the knee slings opened The lower end of the strap is then tucked under the layers of the elastic bandage and the patient steps into specially corrected shoes. The patient is encouraged to be up and about during the two hour rest periods.

This particular routine is now widely used in this area and can be applied quite as effectively in the home as in the hospital

The advent of cortisone, ACTH and their derivatives have been found to materially shorten the treatment periods It is particularly effective when used in combination with Russell Traction, but is also of value when used alone with fixed postural correction. Ordinarily it is prescribed as follows Tablets of 25 mgs of cortone three times daily for an eight day period only This is always accompanied by 5 to 10 grain tables of potassium chloride or acetate to combat the adverse effects of potassium deficiency An eight day rest period is followed by a second or even a third eight day course.

In the individualized practice of the writer two limited types of physiotherapy has been found to be an essential part of adjuvant therapy One is the whirlpool bath for the treatment of the many patients suffering from the combined effects of neurovascular changes in the feet and legs The other is the use of the inductotherm or similar apparati for local application to varied areas exhibiting the effects of primary nerve tension or the pattern of secondary inflammatory changes in the adjoining structures (Figure 30B)

Most are familiar with the beneficial effects of the whirlpool bath as a stimulant to peripheral circulation. The automatic massage of moving air bubbles in water of increased temperature is a standard form of physiotherapy that has most successfully sustained the tests of time. One has only to observe a leg immersed in such medium for a period of fifteen minutes to recognize that the skin below the surface of the water exhibits an intense erythema when compared to that portion of the leg above This treatment is regularly used for the relief of foot and leg

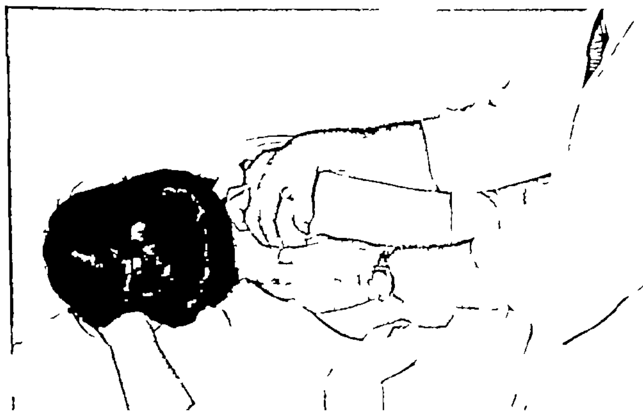




Figure 61. Single Diathermic (Inductothermy) Applicator and Manipulative Techniques. A. Cervico-dorsal zone. B. *Lumbo-sacral zone.* C. *Combined left lumbo-sacral and sciatic zones.* D. *Trapezius kneading for fibrositis.* E. *Trapezius stretching for muscle spasm.*

pains particularly where there is delayed blanching time of inflammatory changes below the knee. A 10 to 15 minute application is followed by appropriate massage, manipulation, or both.

There has been discussed previously in considerable detail, the techniques of fixed postural shoe corrections as they apply to the extremely common and predominantly feminine complaint of metatarsalgia. The manipulative procedure illustrated in Figure 63 A and B is an invaluable supplement to speed recovery from this resistant neuralgia. By increasing the range of motion at the metatarsophalangeal junction, the fixed corrections become more effective in elevating the central metatarsal heads.

The remainder of physiotherapeutic appliances routinely used in our individual techniques consists in the application of modern types of diathermy to the disseminated fibrositic pattern (Figure 30B). Since in the greater number of chronic patients there are multiple areas, treatment may be applied to the neck, midthoracic, low back, or sciatic zones in the same patient. Such technique requires single applicator forms rather than the double cuff method, as an indispensable time saver (Figure 64, A, B and C). Following ten to twenty minutes of such treatment, the patient is given massage and specific manipulations designed to release muscle spasms. An important and regularly effective example is illustrated (Figure 64, D and E). This routine continued for variable periods permits a regular inspection of fibrositic thickenings and muscle spasms. The sum total of these repeated observations on a great number of patients have established our present ideas as to the disseminated fibrositic pattern and their

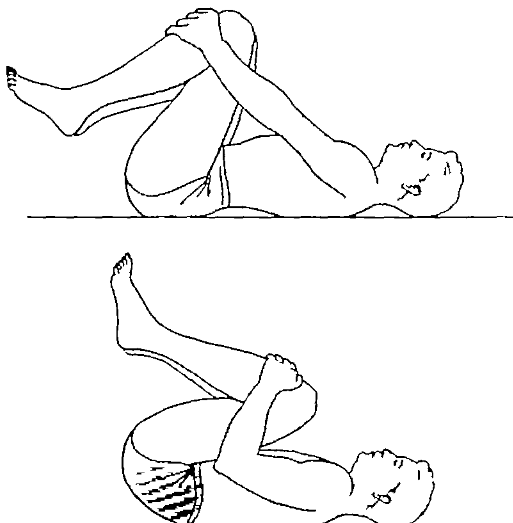


Figure 65 Supine "Stretching Exercise for Release of Nerve Pressure from Pelvic Angulation.

response to fixed postural correction and varied types of adjuvant therapy

Just as physiotherapy has become limited to the two forms which have given demonstrable aid so have recommended exercises been restricted to two simple maneuvers directly designed to release nerve tension. At the time the patients are first given their corrected shoes they are routinely instructed to lie supine on a hard surface, grasp the knees and flex them. They are then instructed to pull the knees under the chin (jack-knife position) (Figure 65 A and B) At no time are the legs extended during the exercise period The patient performs this stretching exercise at least ten times morning and evening, and more, if substantial benefit is attained by this maneuver This exercise is designed solely for the purpose of tilting the pelvic crest backward to release angulating nerve pressure at the lumbosacral angle with corresponding release in the sciatic zone (Figure 12)

A simple foot and leg exercise is prescribed solely for the purpose of avoiding the the malposition of the trigger mechanism When standing without the corrected shoes the patient is instructed at all times to roll both feet towards their outside borders and press the toes down in plantar flexion, as if picking up the carpet (Figure 66) While this simple procedure may considerably strengthen intrinsic foot muscles it is not recommended solely for that distinct purpose Rather it maintains outward rotation of the feet and legs at all times when not wearing corrected shoes eliminating the nerve tension that starts in the foundation (the foot) In the past, too much emphasis has been placed on the value of exercises alone as corrective measures The postural imbalance of an incorrect habitual standing position, viz., the extreme internal rotation, the short leg and other deformities cannot conceivably be corrected by exercises alone

The importance of adjuvant therapy should not

obscure the fact that it is as the name implies simply a series of techniques giving secondary aid. *The primary cause of the varied symptoms arising from postural imbalance continues to be deviations in the lower extremities transmitted to the superstructure*

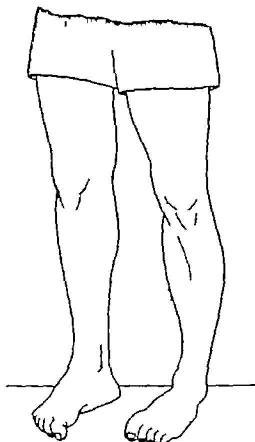


Figure 66 The Foot "Grasping" Position—to Correct Internal Deviation when Barefoot.

CHAPTER TWELVE

The Correction of Foot and Body Posture in Children

THE IMPORTANCE of correction of foot posture in children as it pertains to the improvement of body posture cannot be overemphasized As indicated by the distinct confusion in methods of treatment, one group of practitioners will recommend flexible shoes and exercises, while others endorse fixed correction for varied types of deformities such as rigid removable arch supports for the feet, braces for the legs supports for spinal curvatures etc. Possibly the advice most frequently given by pediatrists that deformity can be neglected as the child will "outgrow it" is in serious error Even a casual observer at any beach will perceive that the great majority of adults are suffering from postural deformity that were not removed by the normal process of growth Indeed, there is much evidence, particularly as regards spinal curvature, indicating that initial deviations, if uncorrected, are actually aggravated by growth

The problems of foot correction in children differ considerably from those found in adults The younger age groups rarely have associated symptoms except for occasional transient neuralgias usually erroneously characterized as growing pains Fatigue however is not an uncommon symptom It may be recognized if the child dislikes active games and in certain cases lack of energy may be reflected in a seeming inattention and mental dullness

There has been previously described in great detail, the role of foot and leg deviation in the production of serial postural distortion (Figure 12) In the great majority of cases adult posture is only the end product of distortions acquired during the growth period There is growing evidence however that growth will tend to eliminate deformities if balance is reestablished As a concrete example, once rotational deformities and strain is relieved on a short leg, the difference of length tends to disappear This same observation applies with equal force to deviational deformities of the lower extremities as they pertain to torsional skeletal shifts in the spinal column Adjuvant therapy usually is not required since the postural defects in children rarely occasion neuralgias of great intensity Further in the presence of resilient structures there is little or no tendency to secondary inflammatory changes

The question is frequently asked "When should one begin to correct foot and body posture in children" For some time the answer has been "before the child starts to walk. This will occasion some surprise, but it should be recalled that most infants, free from disease or congenital anomalies will pull themselves erect usually about the ninth month In many a study of the standing position will reveal that one or both feet may deviate considerably from the straight line position When this is extreme, muscle balance cannot be attained, delaying considerably unaided walking In certain cases of substantial delay there may develop a considerable emotional and inferiority complex

Although there are certain differences basically the correction of children's shoes resembles adult techniques These are first, the choice of the suitable shoe, the reenforcement, and outside correction, and secondly the individual inside correction of this suitably prepared shoe. High shoes, except for dress purposes have been chosen as the suitable shoe for children under the age of six. The small chubby feet of young children lacking bony prominence, cannot be secured firmly in low shoes After the age of six, ordinarily low shoes may be satisfactorily prescribed for correction. The rules for fitting are precisely the same as for adults The first metatarsophalangeal junction, or the prominence at the base of the inside border of the large toe should be slightly in front of the inner flare of the sole, viz., the widest part of the foot should occupy the widest part of the shoe. In addition, a snug heel fit is essential In the past there has been a false emphasis

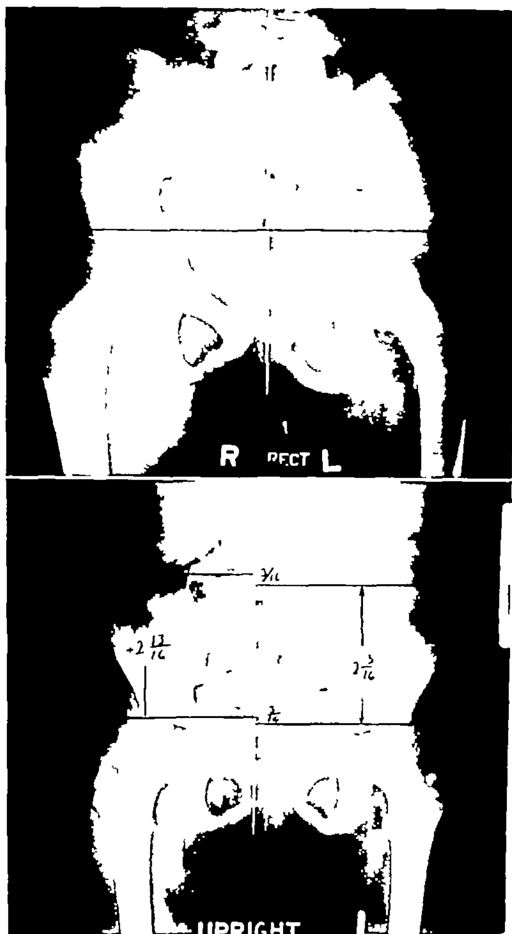


Figure 67 Measurement of Leg Length Difference in Children. A (*Upper*) Antero-posterior radiograph—L.C. Age 12—left leg one-half inch short. B (*Lower*) Antero-posterior radiograph—P G Age 3—left leg $3/16$ inch short.

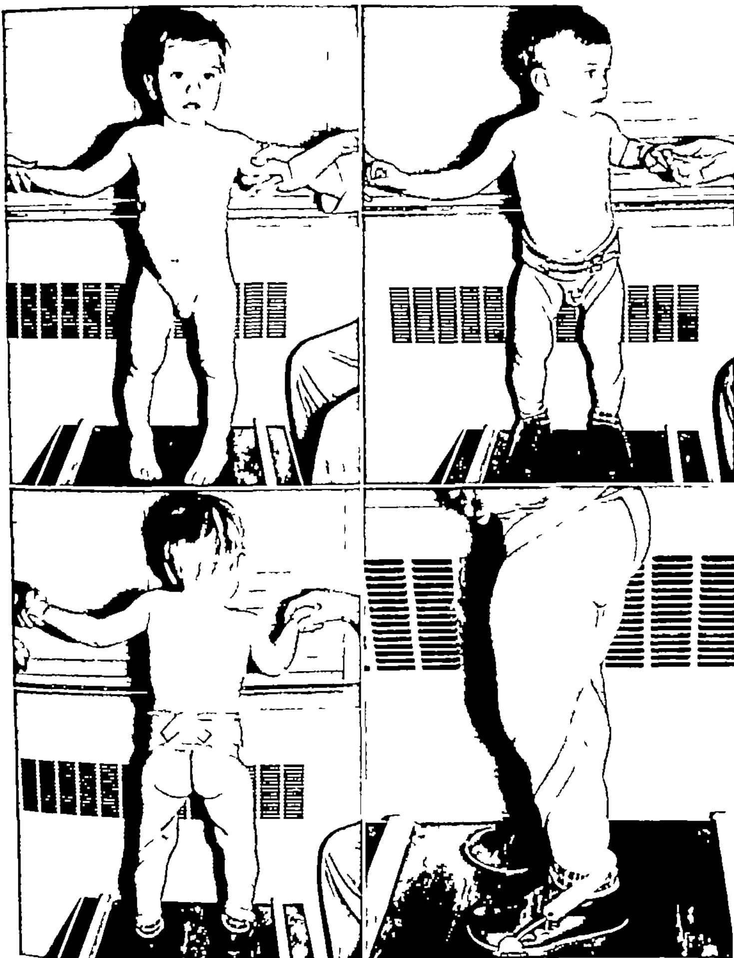


Figure 68. The Correction of Intoeing by Training Straps and Fixed Postural Shoe Correction—S.P Age 18 Months. A. Original deformity—false genu varus (bowlegs) from synchronized linear internal rotation of the lower extremities. B. Front view illustrating immediate correction from pelvic band, training straps and fixed postural shoe corrections. C. Posterior view D Lateral view E (*Next page*) Six months later—continuing improvement.

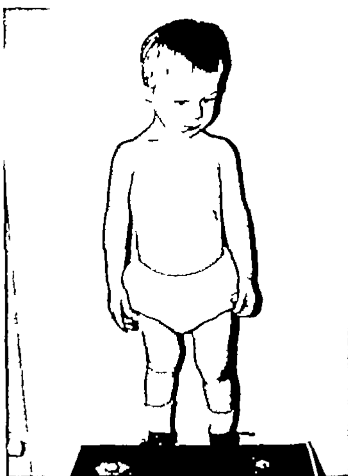


Figure 68E. (*See legend on preceding page.*)

placed on the problem of foot growth To give additional room many shoe fitters interposed the width of the adult thumb between the tip of the shoe and the tip of the large toe The use of this criterion means that many children are fitted in shoes that are too long This fits neatly into a shoe fitting Comedy of Errors in that in the first act the shoes are fitted too large, whereas in the last acts they are fitted too small

Chidren s shoes are reenforced and corrected in exactly the same manner as adults shoes, viz. with plastic reenforcement and sponge rubber inserts There is one difference however anterior arch correction is rarely required. The tests for adequate and inadequate correction are likewise determined in the same manner by the use of the Bimanual Rotatory Test (Figure 31) Similarly difference in leg lengths are detected by measurements on antero-posterior radiographs (Figure 67 A and B) Differing from adult rule which corrects for only one-half of the difference, in children s the heel of the shoe is given full correction This is possible as the child does not have associated neuralgias or other inflammatory conditions to be aggravated by full correction

In one particular the correction of children s posture varies from adult procedures viz. in the correction of rotational deformity of the legs usually described as intoeing or outtoeing Correction is regularly accomplished by the use of training straps connected to the reenforced shoes * The preliminary deformity the end result, the details of the padded pelvic band, the location and direction of the rotatory training straps and the terminal fixation of the straps into the shoes are illustrated in the accompanying series of photographs (Figure 68 A, B C, D and E)

To control outtoeing, the terminus is affixed to the inner border of the sole of the shoe, while for intoeing a reverse fixation is used. It should be recalled that outside shoe correction is also effected by opposites, viz., for intoeing the outer border of the sole is raised, for outtoeing the inner border This procedure, by shortening one set of muscles and lengthening the opposite groups rapidly forces the child to accommodate his gait to this corrected position In some cases the change is effected in a matter of days, while in others it may require considerably longer periods The younger the child the quicker the change.

This method of correction has many advantages over the braces ordinarily prescribed These are not only cumbersome, but quite regularly ineffective. The training straps are inconspicuous and generally meet with parent approval accompaniments not found when braces are prescribed This different approach to the problems of the correction of foot and body posture in children differs materially from ordinary techniques It is not enough to tell the child to hold yourself straight, shoulders back when rotatory imbalance of the legs forces pelvic angulation and its attendant upper spinal deformities In addition, since 40% of the entire population have a substantial difference in leg lengths, it is impossible for the child having this difference to obey Let the

* The training straps illustrated in the accompanying photographs (Figure 68, B, C and D) have been in use for a considerable length of time at the Orthopedic Hospital, Los Angeles, California. Regretably the name of the originator could not be determined.

adult making this unreasonable request roll both feet inward until the knees touch then attempt to stand erect, stomach in, shoulders back with one foot on the curb and the other in the street

Adoption of improved methods for the correction of body posture in children may give a real meaning to the phrase "as the twig is bent so the tree inclines."

PART V
CLINICAL EVALUATION

CHAPTER THIRTEEN

A Clinical Evaluation Based on a Comparative Study

IN THE BEGINNING it was stated that the symptoms arising from postural imbalance constitute a distinct clinical entity This different concept is largely based on a comparative statistical analysis based on 500 cases of chronic low back pain All of the cases were seen consecutively Half of these were contributed from the practice of the writer embracing a period from January 1 1946 to March 1 1949 For purposes of statistical comparison in approximately the *same time period a similar number of cases—250—* was assembled from the joint practices of three independent physicians using the same methods of diagnoses and treatment It should be particularly noted that the patients of one physician were not seen by the others cooperating in the combined study

Inspection of the table (Figure 69) reveals that the 500 cases were divided into two equal portions In the upper section are 250 cases contributed by the writer and in the lower section are 250 cases from the assembled practices of M Wesley Farr El Segundo, California, (85 cases) Royal C. Payne, Hollywood, California, (100 cases) and Harold E Petersen, San Fernando California, (75 cases) The entire number are analyzed from eight different standpoints Although this study is now five years old, one based on present day figures would not be materially altered except as regards a considerable improvement in the time element of therapy

Any comparative study demands a fixed base, the first of which is agreement on a standard or fixed neuralgia. Obviously acute low back pain could not be used since a great number of these respond promptly to a variety of conservative treatments such as drugs, manipulative procedures, phystotherapy rest, and even no treatment whatsoever Neuralgias in other areas such as leg or cervical pains were likewise unsatisfactory as a statistical base since they vary considerably both in intensity and location For a time the use of sciatica alone was considered as a yard stick in that it was ordinarily constant and relatively intractable to treatment. This idea was discarded when it was realized that sciatica was largely only an accompaniment and complication of chronic low back pain For these reasons it was mutually agreed to accept for the purpose of statistical study only cases that had as their chief complaint *chronic low back pain of at least ninety days* continuous duration, and these must have been intractable to previous treatment.

Starting with the sex differential, the first column on the left in the upper series, the males predominate by approximately 10% whereas in the combined figures below there is a considerable female predominance—female 65% male 35% The predominance in the upper series is in error due to the introduction of a considerable number of male Compensation Insurance cases, with the lower series being closer to the true general population figure in that these cases come largely from private practice In all probability the more exact figure on the sex incidence of neuralgias would find a slight female predominance not to exceed a 60 to 40 ratio

The age factor reveals marked similarities rather than differences Although chronic low back pain is occasionally encountered, it is a clinical rarity before the age of twenty This symptom begins to appear after the age of twenty five and then rapidly increases in frequency until in the age period between thirty and sixty it affects a high percentage of the entire adult population. *It would seem therefore that the loss of elasticity of soft tissues and other changes that accompany age progression play a major role in bringing to the surface previously latent conditions* Significantly if patients have not

COMPARATIVE STATISTICAL ANALYSIS
Based on 500 Intractable Consecutive Cases

	Sex	Group Age Incidence	Duration of Chronic Low Back Pain	Allied Symptoms
Laurence Jones, M D Beverly Hills, Calif Statistics from 250 Cases Jan. 1 1946 to Mar 1 1949	Male 55% Female 45	10–20 1% 21–30 12 31–40 29 41–50 39 51–60 14 61–70 4 71–80 1	1 Year or Less 16% 1 to 5 Years 39 5 to 10 Years 27 Over 10 Years 18	Fatigue 82% Leg Aches Fixed 41 Movable 65 Paresthesias 24 Sciatica 48 Upper Root Pain Fixed 29 Movable 38 Paresthesias 13
M Wesley Farr M D El Segundo, Calif (75 Cases) Royal C. Payne, M. D Hollywood, Calif (100 Cases) Harold E. Petersen M D San Fernando Calif (75 Cases) Combined Statistics From 250 Cases Jan. 1 1947 to Mar 1 1949	Male 35% Female 65	10–20 1% 21–30 17 31–40 22 41–50 21 51–60 23 61–70 11 71–80 4	1 Year or Less 12% 1 to 5 Years 32 5 to 10 Years 26 Over 10 Years 30	Fatigue 46% Leg Aches Fixed 33 Movable 14 Paresthesias 11 Sciatica 25 Upper Root Pain Fixed 41 Movable 12 Paresthesias 14

Figure 69

developed low back pain before they reach the age of 60 susceptibility to this symptom almost disappears This has been found to be of considerable diagnostic value, for when chronic low back pain appears after the age of 60 it is usually due to other causes (malignant metastases, spinal cord tumors etc)

The third column is devoted to the duration of symptoms The restriction of choice to those cases that had had chronic low back pain continuously for a period of ninety days or longer resulted in the final selection of a group that had had this particular symptom for extremely long periods of time Of the total 500 cases less than 15% had had their presenting symptom for one year or less More than one-half of the remainder (85%) had had this symptom for more than five years

Certain allied symptoms are found regularly in association with chronic low back pain A close study of this particular category reveals a true and complete picture of the essential unity of the Postural Complex Each of these symptoms are not independent neuralgias due to a single isolated pressure on one or more nerves, but arise from a generalized condition affecting the entire spinal cord and appendages This confirms the mechanisms of the great circle pictures demonstrating that symptoms regularly occur at considerable distances and may be quite as important as the more prominent chief complaint (Figure 12)

Although there is slight variation when the two sets of figures are compared, they bear essential similarity The allied symptoms are grouped into four different classes, fatigue, leg aches, sciatica, and upper root pains The higher figures of the upper tables are thought to be due to the increased incidence of sciatica—48% for the upper 25% for the lower There are in reality only three groups since sciatica can be considered to be a fixed leg pain. It is given a separate classification because of its relative importance as an individual presenting symptom.

These major groupings will be considered in their respective order It can be seen by a study of the table that generalized fatigue is such a common accompaniment of chronic low back pain that it must be considered as an outstanding diagnostic symptom of the postural complex. Fatigue becomes progressively worse with increase of neuralgic intensity For if one correlates the incident of sciatica in the upper table (48%) to the same symptom in the lower table (25%) it will be found that the same relative proportion applies to fatigue—(82% 46%)

OF CHRONIC LOW BACK PAIN
—From Four Different Sources

Frequency of Diagnosis of Disc Protrusion	No.	Analysis of Therapeutic Results		Analysis of Time Element in Therapy		Analysis of the Causes of Failure	No.
Positive Diagnosis (By Others) with Operation Advised but Deferred	38	Substantial Benefit	84%	10 Days or Less	16%	Uncooperative	11
Positive Diagnosis (By Others) With Operation Advised and Performed (No Fusion)	5	Failures	16%	10 Days to 1 Month	35	Failures Due to Causes Other Than Posture	18
Benefited by Conservative Treatment	33	Postural Correction Effective in 84%		1 to 3 Months	2	Technical Difficulties in Patient or Method	11
Failures	10			3 to 6 Months	4		
				6 Months to 1 Year	4		
				Failures	16		
Positive Diagnosis (By Others) with Operation Advised but Deferred	6	Substantial Benefit	87%	10 Days or Less	13%	Uncooperative	15
Positive Diagnosis (By Others) With Operation Advised and Performed (No Fusion)		Failures	13%	10 Days to 1 Month	30	Failures Due to Causes Other Than Posture	9
Benefited by Conservative Treatment	7	Postural Correction Effective in 87%		1 to 3 Months	35	Technical Difficulties in Patient or Method	9
Failures	1			3 to 6 Months	8		
				6 Months to 1 Year	1		
				Failures	13		

The grouping of neuralgias or altered nerve reactions other than sciatica are collected according to their distribution into two major groups upper and lower root pains In the tabulation under Allied Symptoms the upper root pains are listed using this same term, whereas the lower root pains are described under the generic term of Leg Aches This condensation requires a word of explanation in that both of the major groups are again subdivided into three distinctly different classes, fixed pains movable pains, and paresthesias If the leg ache section is used as an example, fixed pains are those that usually remain continuously in one localized area regardless of whether this is in the metatarsal region of the foot, the inside border of the knee, or in other fixed positions Pains that have a tendency to change position from day to day or even from hour to hour are suitably placed in the movable class The third sub-group of neuralgias were given the title of paresthesias to include the many types of altered nerve reactions other than pain Here were placed such symptoms as numbness burnings tinglings crawling sensations etc

The upper root section applies to all neuralgias above the lumbar area Pains were considered as fixed above this level if they remained constantly at a distinct level, or were fixed in one position at the base of the neck, etc. The movable and paresthetic classifications were governed by the same rules described for the differentiation of the lower root pains or leg aches The high percentages of patients having varied combinations of upper and lower root neuralgias in association with chronic low back pain is most significant and should justify the conclusion that the symptoms arising from postural imbalance are due to a general rather than a series of local causes

Sciatica merited a separate classification as does the next category of disc protrusion They are intimately connected as the diagnosis of one almost automatically evokes a diagnosis of the other Of late, this position is shared by the greater number of cases having chronic low back pain without sciatica in that throughout the entire series the same diagnosis was made elsewhere, not once but repeatedly These are not included in this category as this portion of the analysis is reserved for those cases in which positive diagnosis was made by either competent neurologists or neuro-surgeons, many based on positive pantopaque studies Originally patients were not included that had had spinal fusion with disc removal as at the time of compilation it was believed that restriction of lumbo-sacral movement from operative fixation would block pelvic shift.

At present, this restriction is no longer considered valid since many cases with operative failure after prior fusion have had release of tension from foot and leg correction alone. Although recovery in operative cases is slower final results have been improved by the recent development of adjuvant medication (cortisone, etc.) The combined figures of this portion of the table can be multiplied by ten in the light of present expanded experience to confirm the conclusion that this diagnosis is made much too frequently and on insufficient evidence

In the first article written on the subject of low back pain and its relation to foot posture, the statement was made that conservative treatment merits a trial before operative interference is recommended [14] With the lapse of time it is now possible to elaborate further *Conservative treatment alone usually is not enough it must consist of a fixed postural shoe correction that releases spinal cord tension* The statements repeated by many other observers in varied form, that 95% of sciatica [15] and all low back pain [16] are symptoms caused by intervertebral protrusion are completely fallacious in the light of present evidence. *There is obviously such a great margin of error in statistical studies of patients that have had disc removal that the entire subject should be given a new and closer scrutiny*

The sixth column is a summary of therapeutic end results with the next column analyzing the time element needed to secure this change. This particular category (*analysis of time element in therapy*) illustrates most graphically the value of comparative studies For they almost assume the appearance of a mathematical formula. The specific term used here, namely substantial benefit rather than cure has been chosen advisedly for the word cure is a misnomer when used to describe the end results of treatment. Although there are many cases in which symptoms may not recur for long periods of time, there are many others whose symptoms are relieved only for so long a time as fixed postural correction is continuously maintained

It will unquestionably occasion considerable surprise that 15% of both groups of these exceedingly chronic cases were substantially relieved within ten days, and in considerably more than 40% a similar result was reached in one month or less *It would* therefore seem that in this group of cases, in spite of the long duration of symptoms, nerve tension alone without secondary inflammation was the predominant cause of symptoms In the remaining 60% of the cases secondary inflammatory changes were an aggravating factor Recovery was considerably slower and when it occurred can be described, quite *accurately as following a slow fade" type of dis*appearance. This difference in reaction of treatment therefore can only be due to the addition of this secondary (inflammatory) factor In such cases the present improved methods of adjuvant therapy have been particularly effective in decreasing both the time element of therapy and the overall number of failures

The final, or eighth column, is concerned with an analysis of the causes of failure. Many of these patients have been under different forms of treatment for long periods of time without securing permanent relief and are quite understandably skeptical of treatment in general, and particularly of a new approach. Originally there were many uncooperative patients, but these have been considerably lessened with the gradually growing recognition that this different method of treatment offers distinct possibilities There is a small percentage of cases having low back pain due to other causes With the recognition that these are not of postural origin, there has been corresponding decrease in the percentage of failures The final cause of failure, namely technical difficulties either in the patient (joint fixations, etc.) or in the corrective techniques, have been somewhat reduced by improvements in the selection of shoes, the fabrication of reenforcement, corrective devices and new methods of adjuvant therapy

A study of this comparative table has been most instructive. The past history of this large group of patients reveal that ordinarily the patient will consult a practitioner for the relief of the neuralgia

[14] Jones, Laurence Low back pain A different cause and treatment *Industrial Med* 16.2, 57-62, February 1947

[15] Dandy W E. Treatment of recurring attacks of low backache without sciatica *J.A.M.A., 125* 1175-1178, August 26, 1944

[16] Key J A Conservative and operative treatment of lesions of the intervertebral disk in the low back. *Surgery 17* 2, 291 303 February 1945

that is causing great distress at that particular moment The ones that disturbed him last week last month, or in the years before, are quite conveniently minimized or completely forgotten They cannot be blamed entirely for this failure to associate present and past neuralgias, for in the greater number of cases they receive a different local diagnosis for each separate neuralgia

From this statistical table and the series of illustrative cases that will follow one is justified in concluding that at present ***great diagnostic confusion is the rule rather than the exception***

CHAPTER FOURTEEN

A Compendium of Illustrative Case Histories

IT HAS BEEN repeatedly mentioned in the preceding chapters that the concepts as to cause, diagnosis, and treatment of symptoms arising from postural imbalance, differe materially from present day majority opinion. Abstracts have been prepared from a series of illustrative case histories to give point by practical demonstration to these varied differences They were selected from a large number as representing certain significant points of diagnosis and treatment. Although relatively small the group as a whole constitutes a representative cross section of the important phases of the postural problem

The eleven cases to be presented can be divided as representative of the following groups The first and second are used to illustrate certain common problems of diagnosis and treatment The next five cases were selected to demonstrate the tendency to overlook the generalized cause of symptoms when one intense segmental neuralgia dominates the picture. The first of this group of five cases illustrates the dominance of upper root pains, the second, mid thoracic pains and the last three, the manifold problems associated with low back pain and its end product, sciatic neuritis

The final four cases will illustrate certain diagnostic problems frequently associated with the postural complex Characteristic symptoms may fail of recognition when they are overshadowed by other conditions This is particularly true when the other affection is of major severity To illustrate this point these cases had such varied conditions as generalized arthritis, poliomyelitis, encephalitis and severe injury

In all of these the chief complaint, history significant findings, and treatment will be briefly summarized, followed by comment pertinent to the individual case Some will be accompanied by reproductions of significant radiographs and photographic reproductions

Case No 1 Mr R.S. Age 19 6/28/52 (Figure 70 B C, D E, F G and H)

Chief Complaint Multiple neuralgias—Chronic low back pain, leg aches localized foot pains Duration one year

Present History At the age of seventeen low back pains became continuous and progressive on standing or exertion. Disappeared promptly with recumbency Lately moderate aches through the neck and shoulders have been added on first arising. Flat feet" from infancy but these have not limited activities until recently

Past History Negative except for a swollen and painful right knee-joint which necessitated removal of the internal semilunar cartilage two years ago.

General Examination General physique relatively good Slight left total curve apparent in standing position, with the right iliac crest being slightly higher than the left. Lumbar movements in the standing position show a good range of motion without fixation, but side bending in each direction refers pain to the opposite contralateral lumbar region. Slight fibrositic thickening in the lateral areas adjacent to the sacrum. Definitely tender bilaterally to direct finger pressure over the 1st 3rd, and 4th lumbar roots about two inches from the midline On the left side hyperextension leg tests provoke increased lumbar muscle spasm. Bilaterally there is increased trapezius muscle spasm with moderate central fibrositic thickening on the right side

Neurologic Examination Neurologic examination—patellar and heel tendon reflexes definitely hyperactive.

Foot and Leg Examination *Standing* Straight legs, but extreme inward roll with descent of long arches and marked navicular sag.

Sitting There is bilateral severe toe contractures with thick central confluent plantar callouses. There is considerable pain on plantar flexion movement of the toes at the metatarsophalangeal junction.

Radiographic Examination Antero-posterior pelvic view—no significant difference in leg lengths

Diagnosis Postural imbalance, spinal cord tension and localized upper and lower root tension neuralgias—metatarsalgia.

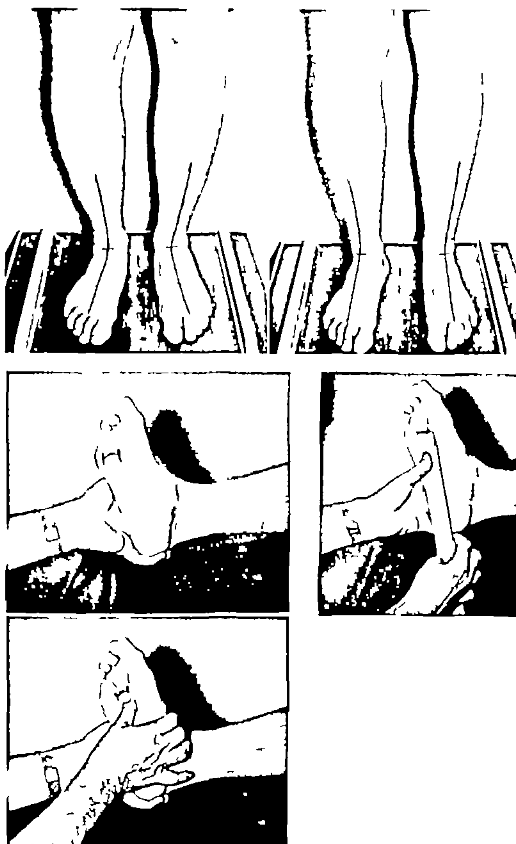


Figure 70 Case No 1—R.S A Young Patient with Multiple Chronic Postural Neuralgias. A (*Upper left*) Standing examination—Uncorrected position showing internal angulation and deviation of weight bearing B (*Upper right*) Standing in corrected straight line weight bearing position. C (*Center left*) Toe contracture. D (*Lower left*) Thumb pressure determining point of maximum toe straightening. E (*Center right*) Ruler technique for determining exact distance of metatarsal correction from heel line. (*Continued on next page*)



(*Continued from preceding page*) F (*Left*) Standing in corrected shoes illustrating ankle bulge of upper on one side. G (*Center*) Standing in corrected shoes illustrating bilateral snug ankle fit by means of tongue pads and extra eyelets. H (*Right*) Technique for full correction in shoes as determined by Bimanual Rotatory Test.

Treatment Patient was given gradually increased fixed postural shoe corrections, physio and adjuvant therapy with immediate relief of upper and lower neuralgias. Residual foot pain however was not entirely eliminated until the final fixed postural shoe correction was attained as follows

Outside shoe correction Bilaterally ⅛ inch raise to the inside border of the sole, beveled metatarsal bars, tongue pads, extra eyelets.

Inside shoe correction Double beveled heel seats (7+3) doubled long arch supports (16+15) anterior arch support (26)

Comment This patient is unusual for the fact that he has a full complement of varied neuralgias at different levels beginning at an extremely early age. Also differing from the majority of other young patients, Mr R.S is a hair trigger type in that the slightest sag from wear in the corrected shoes causes an immediate recurrence of symptoms In his case matters have been complicated by recent induction into the Army where he was forced to wear uncorrected shoes With intense neuralgic recurrence, in spite of his long previous history he was classified, in the routine fashion of the Armed Services as a malingerer However after an exchange of correspondence he was given special permission to wear corrected shoes. Again, symptom free he is in full service This case is unusual in that chronic low back pain is rare in individuals under twenty comprising only 1% of the total number (see Figure 69)

Case No. 2. Mrs C.G Age 43 2/13/48 (Figure 71 A B and C)

Chief Complaint Chronic low back pain. Inconstant sciatica. Duration 10 years.

Present History Low back pain made its first appearance ten years ago Original attacks were severe but inconstant. In the past two years the low back pain has become constant without free intervals Ordinarily is relieved by recumbency although of late is frequently awakened by movement during sleep Variable sciatic radiation of pain affecting both sides, but more often worse on the right. Generalized fatigue has become progressive, aggravated by standing or exertion. Has consulted many practitioners in past two years, two of whom made a positive diagnosis of disc protrusion with operation recommended, but deferred by the patient. At no time has had foot pain or neuralgias in upper segments.

Physical Examination Marked lumbar lordosis. Localized pain on pressure over 4th and 5th lumbar roots bilaterally Considerable lumbar muscle spasm, increased by hyperextension leg tests, worse on right

Foot and Leg Examination Symmetrical feet without significant shoe deformities. High long arches. Small plantar callous under left anterior arch, slight toe contractures with good flexibility at the metatarsophalangeal junction.

X-ray Examination Left leg ¼ inch shorter than the right. Lateral radiographs taken for antero-posterior

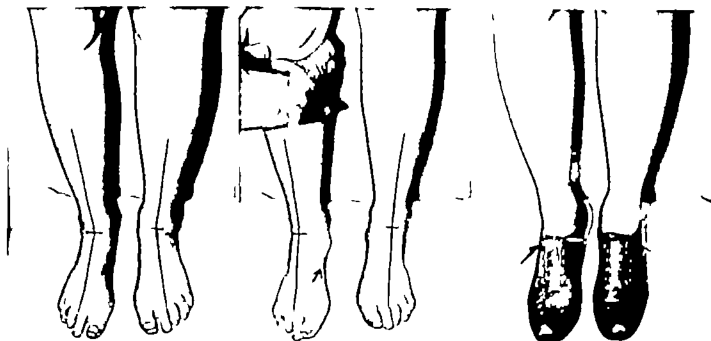


Figure 71 Case No 2—Mrs. C.G Young Matron with Multiple Postural Neuralgias—(Hair Trigger Type) A (*Left*) Standing examination—uncorrected position showing slight internal angulation B (*Center*) Standing in corrected position—straight line weight bearing C (*Right*) Standing in semi style laced oxfords—fixed postural correction.

pelvic shift revealed the following Uncorrected picture taken without shoes—lumbosacral angle—38 5 wearing corrected shoes—lumbosacral angle 35

Diagnosis Postural imbalance. Generalized spinal cord tension—lumbar and sciatic tension neuralgias

Treatment Patient given fixed postural shoe correction, physio and adjuvant therapy Made a satisfactory recovery being substantially free of symptoms in about six weeks as regards both low back pain and sciatica. The sciatic pains and fatigue were permanently eliminated, but she has an extremely sensitive "hair trigger" spinal cord in that there are recurrent twinges with the slightest sag in correction This is confirmed by her history which reveals that she has returned at intervals of 60 days for the past six years for treatment and modification of correction.

Comment This patient has clinical interest in that very slight internal rotatory deviation of the feet and legs caused a slow gradual increase of lumbar neuralgias that finally became continuous The hair trigger response can only mean that very sligh changes of position both cause symptoms and relieve them. This is thought to be due to an abnormally short spinal cord and a tight cauda equina. The lateral radiographs confirm this as correction only affects a 3 pelvic shift Such patients are in a distinct minority comprising about 15 % of the total number

Case No 3 Mr A H C. Age 53 8/4/52

Chief Complaint Constant intractable pain at base of the neck radiating into both shoulders and arms Duration 2½ years

Present History Constant upper root neuralgias tightness of the neck " worse in the morning accompanied by tinglings at the tips of the fingers and numbness of hands— the hands feel swollen but can t see any change Prior to the last 2½ years the patient had transient upper root aches for 15 years without at any time having pains at other levels such as low back or foot pains During this 15 year period the patient had long free intervals, one lasting almost 7 years When pain was present he was under continuous medical treatment from different practitioners Diagnoses have covered the entire scale ranging from the inflammatory types—fibrositis neuritis and arthritis to the opposite extreme where his symptoms were considered to be of pure psychosomatic origin

General Examination Small 5' 6" middle aged male who walks easily without limp or list There is moderate lumbar-lordosis with the abdomen slightly protuberant Head and shoulders are held in the forward position Examination of the spine in standing posture shows a definite left total curve with a right iliac crest being slightly higher On forward bending the lumbar spine is extremely flexible permitting patient to touch the tips of his fingers to the floor without pain Side bending slightly limited to the le[illegible] w[illegible] performed to the

right, with neither movement causing pain referral. Positive findings were entirely limited to the neck and upper dorsal areas. Moderate central fusiform fibrositis extending from the 4th cervical to the 1st dorsal spinous processes The upper segments of the trapezius muscles above the scapular spine, were in spasm and tender from the base of the neck to the point of attachment at the outer border of the scapula. Direct finger pressure reveals marked tenderness over the 5th, 6th, 7th, and 8th cervical roots on the right side, with the same roots on left side being less painful There is also direct tenderness on pressure at the occipito-cervical junction. Reflexes, both in patellar and Achilles, are hyperactive bilaterally with a suggestion of ankle clonus Examination of upper extremity joints reveal no significant changes, and muscle power was well preserved.

Foot and Leg Examination Standing Straight legs, symmetrical feet without shoe deformities There is a bilaterally moderate inward rotation of the feet and legs.

Sitting Patient has slight toe contracture, but a flexible fore foot Heel cords dorsiflex to a point just short of the right angle.

Diagnosis Postural imbalance, generalized spinal cord tension and localized cervical dorsal root tension neuralgias—secondary inflammation (ligamentous and muscular fibrositis)

Treatment Fixed postural shoe correction and physiotherapy consisting of manipulative massage and stretching applied to both trapezius muscles. Adjuvant therapy consisted of several 8 day courses of combined cortisone medication. Symptoms were completely eliminated at the end of three months treatment except for slight sense of neck stiffness on awakening

Comment This case has many points of interest, the chief of which is the diagnostic conflict. This can be duplicated by a large number of similar histories of patients having chronic neuralgias at any level. The fact that these upper root neuralgias were never associated with symptoms at other levels makes this an unusual case.

Case No. 4. Mrs. M.C.K. Age 29 2/13/48 Bank Teller Case referred by Dr H E Petersen, San Fernando California.

Chief Complaint Pain in left chest. Duration one week.

Present History One week before date of examination by Dr H E. Petersen, patient suffered severe dull pain in left chest In the beginning this occurred two or three times a day but of late pain has become increasingly frequent With this, there is a pain at the base of the neck radiating into the shoulder and down the left arm. Patient has had prior minor transient attacks of low back pain, but no foot or leg pains She has complained of shortness of breath accompanied by a "choking" sensation For some time past there has been gradually increasing fatigue She consulted another physician before seeing Dr Petersen, who made a positive diagnosis of cardiac angina. Two different sets of electrocardiograms were taken, both reported as negative. The last physician (Petersen) made a tentative diagnosis of thoracic radiculitis, complicating postural nerve tension

Physical Examination Summary of significant findings Tall, well built adult female who walks without limp or list. Appeared to be in excellent health but was apprehensive due to previous diagnosis of neuralgias of cardiac origin. Examination failed to reveal any fibrositic thickenings in any of the segmental areas, nor was there any limitation of motion or muscle spasm. However spinal examination, prone, did reveal nerve root tenderness on direct finger pressure on 6th, 7th, and 8th dorsal roots on the left side. This pressure caused pain to radiate to the front of the chest.

Foot and Leg Examination Revealed straight legs, symmetrical feet, internal deviation of slight degree.

Diagnosis Postural imbalance—thoracic radiculitis.

Treatment Patient was given fixed postural shoe correction and adjuvant medication. All symptoms disappeared within two weeks and she resumed active work. She has been seen at intervals by Dr Petersen for other conditions for the past several years, but there have been no recurrences of thoracic pains.

Comment Patients with this particular isolated symptom ordinarily do not consult orthopedists, and when they do they are usually referred by internists. In the numerous cases where electrocardiograms are negative, it might be well to question the patient as to the past history of other neuralgias Of course, since both conditions viz., postural nerve tension and anginoid neuralgias affect a high percentage of the entire adult population, they might commonly appear in the same patient in varied combinations. In certain of these fixed postural shoe corrections might be considered not only as a treatment, but as a therapeutic test. Differential diagnosis is not aided by the fact that neuralgias of both types are usually promptly relieved by recumbency or rest. However the history of past neuralgias in other areas when combined with the presence of localized thoracic root tenderness in the presence of a complete negative electrocardiogram, should make one consider this

as an alternate possibility Since both cardiac decompensation and the generalized spinal cord tension of postural imbalance regularly cause severe fatigue the presence of both in the same patient may result in considerable aggravation Relief of postural imbalance may therefore give substantial benefit by breaking a vicious circle

Case No. 5 Mr C.C.H Age 54 7/28/52 (Figure 72, A B C, D and E) Case referred by Dr Robert T Pottenger Pasadena, California

Chief Complaint Low back pain Duration 35 years

History Thirty five years ago patient suffered compression fracture of the lumbar vertebrae while playing football. Seven years later he had an acute attack of sciatica lasting ten years and then was free of symptoms for about ten years Sciatic neuritis recurred in 1933 lasting one month. After this, painful periods became more frequent. In 1950 he was jointly operated by a neuro-surgeon and an orthopedist for disc protrusion. When this was not found a fusion by bone grafts was performed. The operation gave slight relief for a short period followed by an intense aggravation which has persisted to date. In the past two years he was under the constant attention of Dr Robert T Pottenger Pasadena, California. Under the diagnosis of vertebral arthritis, he was treated by diet and medication. Patient was referred by Dr Pottenger to determine if postural imbalance was a factor in the continuance of symptoms.

General Examination Reveals a tall well muscled adult, walks with slight limp to the left and with a forward bend to his entire spinal column

Spinal Examination Standing Total curve to the left. Long posterior midline scar starting just above the second lumbar spinous process and extending to the cleft of the buttocks On forward bending the lumbar spine is held in complete rigidity the fingers missing the floor by 18 inches On side bending movement is also severely restricted, and all movements refer intense diffuse pain to the lumbar area.

Supine Straight leg raising—bilaterally—to the 80 angle without blockage by pain or muscle spasm Crossed leg test—negative—bilaterally Circular leg measurement at comparable levels reveal no significant difference

Prone Changes from the supine to the prone with many breaks in the continuity of movement No appreciable fibrositic thickening over the base of the sacrum, in the lateral expansion, or in the gluteal crescents. No tenderness over the sciatic openings. Hyperextension leg tests reveal rigidity at the lumbosacral junction and intense constant muscle spasm

Neurological Examination Patellar and heel jerks definitely hypoactive

Foot and Leg Examination Standing Feet are slightly outtoed Retention of long arch symmetry Slight dorsal exostosis over the head of the left 1st metatarsal Band of redness on the inner dorsal border of the left foot with a slow blanching time, this lag being considerably decreased by external rotation of the foot and leg (Bimanual Rotatory test) The same test reveals that habitual internal rotation of the feet and legs were estimated as between the mild and moderate varieties

Sitting Bilaterally slight toe contractures, flexible fore feet, heel cords 10 short.

X ray Report Pelvis Upright The right side of the pelvis is elevated 5/8 above the left as measured at the upper margins of the acetabular indicating the right limb is 5/8 inch longer than the left. The iliac crest on the right is 3/4 inch higher than the left. There is evidence of old injury at the outer margins of the acetabulum, possible old fractures On the right, a small separate ossicle is present On the left, there is a larger fragment which appears partly fused to the upper outer margin of the acetabulum Moderately advanced osteoarthritic changes are noted in the lumbosacral spine as visualized in the a—p view

(Drs Peha and Spishakoff Beverly Hills, California)

Diagnosis Postural imbalance, lumbar root tension neuralgias with secondary inflammation, osteoarthritis, traumatic and post operative aggravation.

Treatment Fixed postural shoe corrections adjuvant therapy consisting of physiotherapy and massage Also given two 8 day courses of cortone and adjuvant medication. Symptoms disappeared gradually by slow fade reaction over a period of three months. He has been seen at frequent intervals during the past two years and has been substantially free from symptoms up to the present time.

Comment This case has many points of interest. The initial cause would ordinarily be considered as a trauma of major magnitude with multiple fractures But once he had recovered from the initial injury the free intervals followed by a history of repeated, gradually increasing attacks is particularly diagnostic for the neuralgias of postural origin When these become continuous and constant, secondary inflammation can be considered as aggravating the original generalized and localized nerve tensions The pelvic imbalance was of two distinct types To antero-posterior angulation from internal leg rotation was added a considerable lateral inclination



Figure 72 Case No. 5—C.C.H Middle Aged Male with Severe Low Back Pain and Sciatica—Long Duration. Fusion and Operative Failure. A (*Upper left*) Standing Examination showing slight internal angulation, the cause of severe symptoms. B (*Upper right*) Standing examination—bimanual rotatory shift producing straight line weight bearing. C (*Lower left*) Standing position—increased height of right iliac crest—lumbo-sacral post-operative scar D (*Lower right*) Standing examination—posterior view—fixed postural shoe correction—heel lift—straight line weight bearing. E (*Opposite page*) Antero-posterior radiograph (*standing*)—left leg one half inch short.

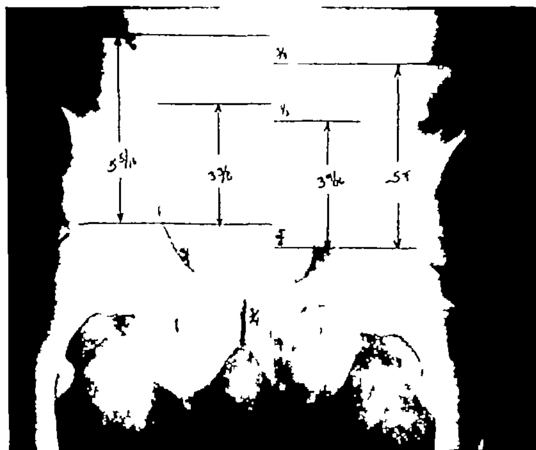


Figure 72E. (*See legend on opposite page.*)

from a short leg With the correction of these two defects there was some initial relief of pain from relaxation of nerve tensions Symptoms, however did not disappear substantially until adjuvant therapy relieved intense secondary inflammatory changes There are two lessons to be learned from this case, one, that spinal operations should not be performed until the possibilities of this specialized type of conservative treatment have been exhausted and two that even after operative failure this different approach still gives hope that the patient may be given substantial benefit.

Case No. 6. Mrs L.M. Age 51 4/5/52 (Figure 73 A and B) Referred by Dr Robert T Pottenger Pasadena, California

Chief Complaint Multiple neuralgias—chronic low back pain 6½ years foot pain 20 years

History With prolonged standing patient (teacher) suffered for many years with pains in long and metatarsal areas of both feet. About 6½ years ago she suffered an acute attack of low back pain. This became continuous on standing, but was usually relieved by lying down. Lately she no longer experiences this relief and is wakened by pain on movement during sleep. Pain is always sharply localized to the low back region without other radiation. No upper root pains save for occasional numbness of the fingers For the past four months has been treated by Dr Robert T Pottenger for arthritis, and was referred for postural foot correction.

General Examination Middle aged female who walks slowly but without limp or list.

Spinal Examination Standing Forward bending, lumbar segment is held rigidly with the only movement at the hips Side bending similarly limited, and all movements refers pain to the lower lumbar area.

Supine Without positive findings except that straight leg raising test reveals moderate hamstring contractures.

Prone Slight fibrositic thickening over the base of the sacrum extending into the lateral expansions and the gluteal crescents Hyperextension leg tests bring on intense lumbar muscle spasm. Direct finger pressure reveals decreasing bilateral tenderness as one proceeds upward from the 5th to the 4th and 3rd lumbar roots.

Foot and Leg Examination Marked multiple shoe deformities Large exostoses both dorsal and lateral over the heads of both 1st metatarsi with some adduction deformity Also lateral exostoses over the heads of both 5th metatarsal—double bunionettes (tailors bunions) The large toes do not over or underride the next small toes, but have pushed them outward. In

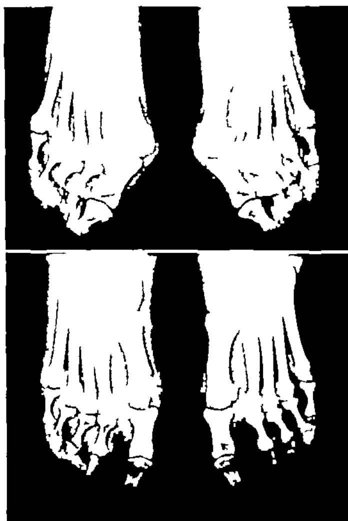


Figure 73 Case No. 6—Mrs. L.M. Multiple Chronic Postural Neuralgias and Foot Deformities. A (*Upper*) Antero-posterior radiograph showing multiple shoe deformities—adducted Hallux Valgi (bunions) and bunionettes. B (*Lower*) Antero-posterior radiograph—six months post operative—corrected position maintained.

the standing position the long arches are lowered with navicular sags. Symmetry is reestablished by Bimanual rotation, with the deviation estimated as extreme

Diagnosis Postural imbalance—generalized spinal cord tension, multiple lumbar root tension neuralgias, multiple shoe deformities—(bunions bunionettes)

Treatment Patient given fixed postural shoe correction, but severely limited by multiple foot deformities. Within two months was considerably but not entirely relieved of lower lumbar pain, while there remained a considerable residium of foot pain. On March 7 1953 a double plastic bunionectomy was performed. This consisted of tenotomizing the transverse head of the adductor hallucis tendons at the same time freeing fibrous fascial and joint contractures The capsule of the joint was opened and the thin projecting roughened outside layer of the metatarsal head removed The abductor hallucis tendon was then isolated from its position beneath the metatarsal head and split lengthwise to make a double head The forked tendon was then sutured to the upper and lower margins of the distal end of the capsule to pull the toe into the straight line abducted position The lateral exostoses, (bunionettes) were then resected. Patient wore plaster slippers for 10 days Corrected shoes were then worn opened down the front, with the lacing area extending almost to the tip of the shoe Post operative swelling gradually decreased over a period of two months. When this had completely disappeared it was possible for the first time to fit the patient with satisfactory shoes having a snug heel lift. From this point on, fixed postural shoe correction has given complete foot, leg, and back relief

Comment This case is of interest only in demonstrating conclusively the significance of foot (shoe) deformities When these are severe it may be impossible to satisfactorily correct body posture through the medium of shoes The presence of severe bunion deformities may make the foot so wide in front as to preclude the snug heel fit essential to the elimination of internal rotatory deviations It has long been our custom, when confronted with single or double bunions of extreme character particularly where these over or underride the adjoining toes, to refuse to give such patients shoe correction until the foot deformities have been relieved by operative procedures This applies with equal force to severe fixed (immovable) hammer toes The operation for the correction of Hallux Valgus (bunion) described above has been repeatedly demonstrated in the practice of the writer to be infinitely superior to other procedures The straightening of the large toe by restoration of muscle balance is quite as effective as the plastic procedures used for the correction of strabismus In spite of counterclaims, Hiss is unquestionably the originator of this superior plastic repair *

Case No 7 Mr G.S.B Age 34 10/30/50 Mechanic, Compensation Case A42 13302 Emp Mut. Liab Ins. Co

Chief Complaint Chronic low back pain, left sciatic neuritis Duration 10 months

History Injury occurred 8/29/49 after lifting heavy wooden block. Although injury did not immediately disable him the following day low back pain became so

* Hiss, J M Hallux Valgus—Its Cause and Simplified Treatment. *Am J Surg* 11 51 57 Jan. 1931

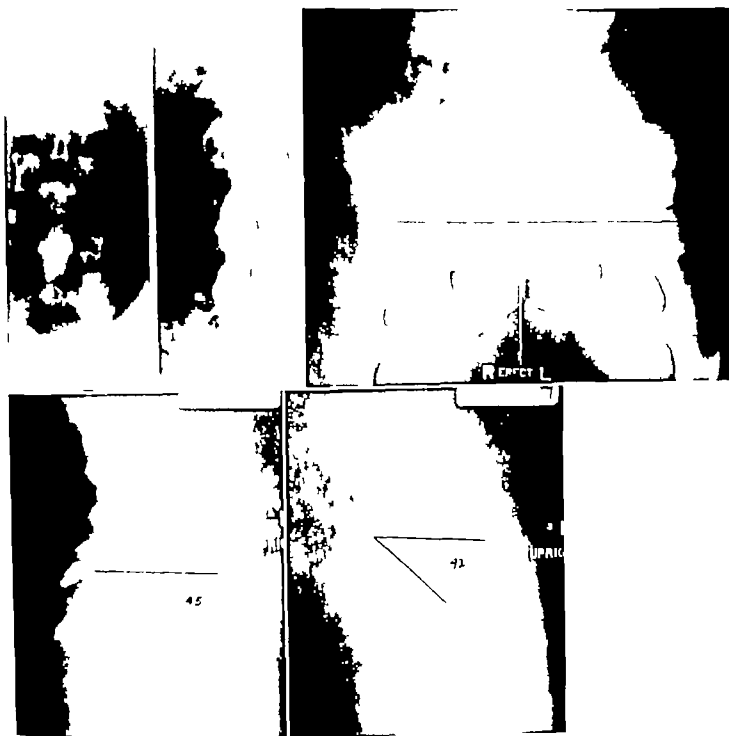


Figure 74 (Case No 7—G.S.B. Chronic Low Back Pain and Sciatica (Hair Trigger Type) Large Scale Disc Protrusion. A (*Upper left*) Previous pantopaque study—large filling defect in interspace between the 5th lumbar body and the base of the sacrum. B (*Upper center*) Pantopaque study—questionable filling defect at interspace between the 4th and 5th lumbar vertebral bodies C (*Upper right*) Antero-posterior radiograph (standing)—right leg one half inch short. D (*Lower left*) Lateral radiograph (standing)—Vertical Wire measurement—fixed postural shoe correction—lumbo-sacral angle 42 E (*Lower right*) Same view in uncorrected (barefoot) position—lumbo-sacral angle 54 —a three degree insufficient shift.

severe that he was hospitalized for one week. On returning to light work symptoms gradually increased until two months later there was radiation into the left buttock and down the back of the left leg In the beginning recumbency gave short periods of relief and ordinarily he slept well With increase of symptoms patient was referred to neuro-surgical specialists in Santa Ana, California, and under their direction pantopaque studies were made. These revealed a large filling defect in the interspace between the 5th lumbar vertebrae and 1st sacral segment (Figure 74 A and B) Pantopaque occasioned an unusually severe reaction charac

terized by headaches and an increase of all symptoms. Mental excitation was so extreme that he has no recollection of this period, but was informed by his wife that he had to be placed in restraint. Now headaches are present on awakening, but disappear with medication or food intake. When low back pain becomes severe he has a sense of tightness in back of neck and shoulders without other radiation to the upper extremities Fatigue is present in moderate intensity Although able to work a full day at light duties he must retire immediately after dinner

General Examination Reveals a tall, thin adult male who walks slowly but without discernable limp or list. States he lost 13 lbs. in past two weeks

Spinal Examination Standing Spine has a total curve to left On forward bending a slight lumbo-sacral bend with practically all forward movement being limited to the hip joints. Side bending sharply limited bilaterally with all movement referring pain to low back and right buttock areas

Supine Straight leg raising—right—elevates to right angle without pain referral left—elevates to 60 angle with further movement blocked by pain and muscle spasm. Cross-leg test—right—negative left—pain is referred to low back region.

Prone Patient changes from supine to prone position with slight breaks in continuity of movement. Palpation reveals no thickening over the base of the sacrum, lateral expansion, or gluteal crescents Lumbar muscles are moderately tense on both sides. Direct finger pressure reveals tender areas over the 4th and 5th lumbar roots bilaterally and pain on pressure over the left sciatic opening Hyperextension leg tests—bilaterally—slight lumbo-sacral bend, but immediately thereafter there is rigidity from increased lumbar muscle spasm. Rotatory leg tests—bilaterally—cause slight twinges in low back region. No central cervical fibrositis.

Neurological Examination Knee reflexes—bilaterally—hyperactive, more on left. Heel jerks hyperactive, slight ankle clonus on left.

Foot and Leg Examination Standing Dorsal exostoses over the heads of both 1st metatarsi—larger on left. The long arch symmetry fairly well preserved with the inner borders of the plantar fasciae tight bilaterally Bimanual rotation—inward roll of 10 plus, left—10 minus—right

Sitting Bilaterally forefeet are flexible without plantar callouses Heel cords can be dorsiflexed to a point slightly short of the right angle.

X ray Examination Standing antero-posterior radiograph reveals that the right leg is 11 mms. shorter than the left (Figure 74C) There is opaque oil in the vertebral canal. (S S Steinberg, Radiologist, Beverly Hills, California.)

Diagnosis Postural imbalance. General spinal cord tension, left sciatic neuralgia, large intervertebral disc protrusion, left, in the interspace between the 5th lumbar and the base of the sacrum.

Treatment Patient given postural shoe correction as determined by examination, modified to include a 1/4 inch balanced heel raise to the left shoe. He was hospitalized 10/31/50 for a five day period of intermittent Russell or balanced traction. During this time small doses of cortisone were given every six hours with potassium cloride 5 grs. After one week rest period this treatment was repeated for another five days There was immediate improvement and after three weeks of office treatment there was an almost complete disappearance of both subjective symptoms and objective signs With subsidence of pain on 12/27/50 lateral radiographic measurements were made in the standing position demonstrating the change in degree of pelvic angulation effected by fixed postural correction (Figure 74D) Lateral radiographic pictures made in the standing position and wearing the corrected shoes reveal the lumbo-sacral angle to be 42 With the shoes removed a similar view reveals the lumbo-sacral angle to be 45 (Figure 74E) The conclusion at that time was that the 3 degree pelvic shift produced by correction was insufficient, and one that would predispose to recurrence. Patient was seen at 60 day intervals and was found to be having occasional slight lumbar and sciatic twinges but was able to work without interruption. On 4/18/52, there was a return of intense low back pain and sciatica. Patient states that prior to date of aggravation he had twisted the left foot and leg while walking in sand. Since the previous routine treatment had given relief he was again referred to the hospital for balanced traction and adjuvant therapy Again, there was relief of symptoms and he returned to work and continued without significant interruption until 12/1/52. In this interim he frequently returned to the office as he was never completely symptom free, suffering low back and sciatic twinges with the slightest corrective shoe sag from wear On 12/1/52, patient had intense recurrence of left sciatic pain and generalized muscle spasm with marked sciatic list. As conservative treatment had failed to give satisfactory results, he was referred to Dr Tracy J Putnam, Neuro-surgeon, Beverly Hills, California. His conclusions were "It was my impression that this patient has a herniated intervertebral disc at L 5 or L-4, or both. He has certainly exhausted all possibilities for conservative therapy and advise that surgical treatment be carried out as soon as possible." On 12/11/52,

Midway Hospital, Los Angeles, California, an exploration was performed. Exposure failed to reveal any pathological reason for the extremely large filling shadow found at the intervertebral space between L 5 and S-1 There was however a large scale disc protrusion extending completely across the next intervertebral space above L-4 and L 5 seemingly pressing on both left and right lumbar nerve roots The protrusion was friable, necrotic, and had to be removed by curettement There was intense dural injection. Patient's post-operative course was satisfactory in that there was immediate relief of the intense lumbar and sciatic pain

Comment The satisfaction resulting from this post-operative change was short lived Patient found that he could not walk across the floor barefoot without twinges in the lumbar and sciatic regions As this is written, 4/20/54 he is still being treated for a recurrence of lumbar neuralgias of moderate severity Residual sciatic irritation is evidenced by transient pains at the back of the left knee This particular case is interesting in that it indicates that all too frequently disc protrusion may be an aggravating rather than a primary factor in the causation of neuralgias Not only have many patients been given permanent substantial benefit in the presence of positive pantopaque studies, but many suffer early or late recurrence of symptoms after the removal of a protruded disc.

Case No 8. Mrs. L.M. Age 23 1/31/52 Referred by Dr Robert T Pottenger Pasadena, California.

Chief Complaint Chronic arthritis Duration 8 years

History Patient has had an almost continuous history of varied joint difficulties since the age of 16 In the beginning had transient pain and swelling of both knees diagnosed as due to rheumatic fever During this period she was in bed constantly for three years, and relatively inactive for a year after this. She was married became pregnant in 1948 and significantly was relatively free from symptoms during this time Two months after delivery pains recurred in aggravating and spreading form to affect in addition to the knees the ankles and feet. For the first time transient pains made their appearance in both elbows and the right shoulder For the past three years had been under continuous treatment by varied specialists and was given several courses of cortisone with only slight transient benefit. For the past four months was under the care of Dr Pottenger and lost 13 lbs. from a reduction diet. There had been a considerable decrease of symptoms, but sustained weight bearing was poorly tolerated and progressive fatigue had become an outstanding symptom. As a result she was referred for fixed postural shoe correction as an adjuvant treatment

General Physical Examination Reveals a young female of medium height and body weight who walks with great difficulty and obviously suffering severe pains The upper extremity examination reveals that in the right shoulder there is localized central pain on pressure just below the acromio-clavicular arch with a definite twinge on external rotation. Elbows do not appear to be thickened, but there are definite twinges at the extremes of the ranges of motion.

Spinal Examination Standing Slight total curve to the left with the right iliac crest being slightly to the left Forward bending—has an excellent lumbosacral bend, being able to touch the tips of extended fingers to the floor Side bending—equally well performed and all standing movements were accomplished without pain referral.

Supine Straight leg raising bilaterally elevates to the right angle without blockage of movement or pain referral Cross leg test (heel to opposite knee) negative. Examination of individual joints reveal that both knees are reddened and swollen. Measurements mid patellar right—15½ left—16¼ On both sides there was free fluid present as indicated by distinct patellar float. Ankles are also swollen mid-malleolar—right, 10⅞ left, 10⅝ The right knee is sharply limited at the extremes of the range of motion, the left slightly less. Both ankles are free in flexion but slightly restricted at the extremes of range of extention. There is redness and puffy swellings of the dorsal surfaces of both feet extending into the toes—large and first small toes on the right—large and first and second small toes on the left.

Foot and Leg Examination Standing Reveals bilaterally a severe synchronized internal rotatory deviation. Marked sag of both long arches and moderate metatarsal descent.

Radiological Report Standing radiograph reveals ¼ inch shortening of left leg Other radiographs reveal slight reactive changes in the right sacroiliac joint and nominal degenerative arthritic changes in both knees—sharpening of the articular margins of the tibiae. (Dr J G Conti, Radiologist, Beverly Hills California.)

Diagnosis Multiple postural neuralgias. Multiple rheumatoid arthritides

Treatment Because of extreme internal rotation and other deviational deformities, fixed postural shoe correction was prescribed. Because of the intensity of the inflammation this was performed very gradually about two weeks elapsing between each upward revision Ad

juvant physiotherapy for the lower extremities consisting of whirlpool baths and light massage. Medication was restricted to mild sedation for pain. Follow-up notes revealed a remarkably rapid recovery considering the severity of symptoms and their long duration Two weeks after initial shoe correction pains in the right shoulder and both elbows completely disappeared Within one month excess fluid was absorbed from both knee joints and the marked swelling of the ankles and the dorsal surfaces of both feet and toes were greatly reduced. Within two months, with gradually improved correction, there was a complete disappearance of all neuralgias and joint swellings Patient resumed full activity to such an extent that she was able to dance

Comment As a therapeutic test this case reveals that fixed postural shoe correction is a dominant factor in the treatment of arthritis Patient had been under continuous medicinal treatment for more than three years, receiving conventional treatment of varied types including prolonged administration of cortisone on three different occasions In spite of this there had been extensive aggravation of the disease and considerable deterioration For test purposes all specific medication was discontinued except for mild sedation for pain The experience derived from this first and subsequent cases convinced Dr Pottenger a specialist of national reputation, that it was necessary to apply fixed postural shoe corrections to relieve postural imbalance in the greater number of cases having arthritis. In the opinion of this writer it is believed that arthritis is benefited for two different reasons one local the other general Locally an ankle, knee hip and even pelvic joint may suffer increased wear from deviation of weight bearing lines Generally release of spinal cord tension may act powerfully to stimulate general body metabolism, including a restoration of depressed glandular functions Although there may be some difference of opinion between Pottenger and myself as to the mechanism promoting recovery there is none concerning the efficacy of postural correction.

Case No. 9 Miss M U Age 43 3/30/53 Referred by Dr Ernest Russell, Neurologist, Santa Barbara, California.

Chief Complaint Encephalitis—Multiple neuralgias—intense generalized fatigue. Duration 6 years.

Present History Six years ago became acutely ill with initial high fever severe headache, and muscle spasms, all followed by a loss of consciousness. A diagnosis was made of infectious encephalitis From this there was an unusually slow recovery Patient was almost completely bedfast for the first three years. In the subsequent three years attempts to resume activity were blocked by the following symptoms intense neuralgias at the base of the neck and low back region. When pains were at their worst she could not find comfort in any position, either sitting or lying down With any increase of exertion, fatigue immediately became an outstanding symptom. For example in the week before the above date she used a vacuum cleaner for about one half hour From this *slight movement* she was *forced to seek bed rest* for a period of four days.

Past History Reveals no other significant illnesses or operations Prior to the onset of encephalitis she had occasioned transient foot pain, sometimes frontal headaches. No other history of segmental neuralgias.

General Examination Reveals a middle aged female who seems to be mentally alert, and walks without limp or list.

Spinal Examination Standing Total curve to the left with right iliac crest distinctly higher than the left. Forward bending—normal lumbosacral curve with extended fingers almost touching the floor Side bending was bilaterally well performed with none of these spinal movements causing pain referral.

Supine Examination of joints ankles, knees, and hips reveal no abnormalities of shape or function Straight leg raising well performed bilaterally Cross leg test (heel to knee) performed without pain referral

Prone Changes from the supine to prone position easily Examination of the spinous midline reveals a distinct fibrositic thickening over the base of the sacrum which extends into the right lateral expansion without thickening in either gluteal crescents Finger fork test reveals marked tenderness over the right 5th lumbar root In the midline of the neck, starting at the 4th cervical and running to the 2nd thoracic spinous process, there is a central fusiform fibrositic thickening which is extremely tender on pressure Both trapezius muscles are in spasm with some fibrositic thickening in their outer upper borders. Tension in this area is increased when examination is made in the sitting position.

Neurological Examination Knee, heel, biceps, and triceps tendon reflexes are exceedingly hyperactive bilaterally with moderate ankle clonus

Foot and Leg Examination Standing Moderate knock knees. Slim feet without shoe deformities except for considerable toe flexion contractures Fairly good retention of long arch symmetry although internal devia

tion of weight causes slight sag. Inward rotation is further demonstrated by slight puffy swelling below both external fibular malleoli. Bimanual rotatory tests reveal an extreme inward roll on the left, a moderate one on the right.

Sitting. Thin discrete plantar callouses over the heads of the 2nd and 3rd metatarsals—right, bilaterally flexible fore feet with short heel cords that permit dorsiflexion to a point 10° short of the right angle.

Radiographic Measurement. Standing. The tops of both acetabuli projected to the vertical wire reveal that the left leg is ½ inch shorter than the right. This same difference is found at the level of the iliac crests (Figure 75). This figure (Figure 75) illustrates that at one time three comparative measurements were projected to the vertical wire, viz., the acetabular, the iliac crests, and the angle of the sacroiliac joint. Although this latter point is clearly demonstrated in this particular radiograph, in many others it is difficult to determine this exact point. (Lewis Peha, Radiologist, Beverly Hills, California.)

Diagnosis. Encephalitis complicated by Postural Imbalance—General spinal cord tension—multiple root tension neuralgias.

Treatment. Patient was given gradually increased fixed postural shoe correction with the shortness of left leg partially corrected by a ¼ inch balanced heel raise to the left shoe. Adjuvant therapy consisting of two interrupted eight day courses of cortisone and assistant medication. Physiotherapy consisted of inductothermy and stretching exercises directed chiefly toward bilateral trapezius fibrositis and spasm. Recovery was exceedingly rapid considering the severity and long duration of the original illness. After three months of treatment there was almost complete relief of both upper and lower root neuralgias with a corresponding decrease of fatigue. Six months later she resumed full time work as a secretary in San Francisco.

Comment. This case has special interest in that the original severity of the disease and its location caused considerable diagnostic conflict as to the reason for the continuance of symptoms. Most observers reasoned that the multiple neuralgias were

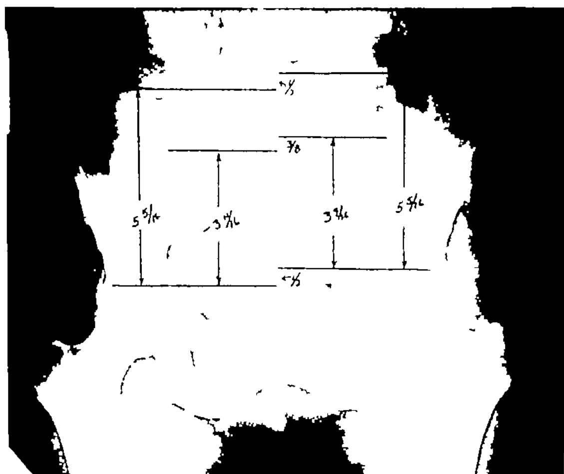


Figure 75. Case No. 9—Miss M.L.U. Multiple Postural Neuralgias Complicating Recovery from Severe Encephalitis. Antero-posterior radiograph depicting a significant difference of leg lengths.

the direct result of chronic inflammatory (post-encephalitic) changes The referring specialist (Russell) questioned this Although encephalitis was unquestionably the activating mechanism that increased a latent spinal cord tension, the final result of treatment proved that serial postural deviations rather than the scars of original infection were the aggravating cause of symptoms.

Case No. 10 Miss M.P Age 41 3/8/49

Chief Complaint Poliomyelitis and post poliomyelitic deformities—38 years. Multiple neuralgias—2 years

Present History Two years ago patient had an acute attack of low back pain which originally was considered as due to the retroversion of an enlarged uterus. Conservative treatment gave some relief Three months ago pains in the neck, shoulders, and lower chest region made their appearance. These were not constant but varied in their location and intensity from day to day As a piano teacher she particularly complained that hand and arm movements for long periods considerably aggravated symptoms causing "an interlacing of pains and a tightness in the neck." Generalized fatigue on exertion became progressively worse. Lower extremity pains were of the movable types in that they were transient, not of great severity and regularly varied in location. Several months prior to examination she had "eruption" on posterior surface of the right thigh diagnosed as "shingles"

Past History Patient had poliomyelitis at age of 2½ years resulting in severe multiple deformities Both legs were seriously affected, more so on the right, marked by dropped" foot and back knee deformity Spinal curvature of extreme S-curve structural type made its appearance and became rapidly worse during the growth period. In 1945 a local orthopedist performed a triple arthrodesis on the right foot and ankle resulting in a satisfactory fixation for the previously dropped or dangle foot. Later another orthopedist performed a nerve crushing operation without any benefit whatsoever

Physical Examination Reveals a short, middle-aged, slightly overweight female who walks with great difficulty without shoes.

Spinal Examination Standing Patient has extreme S-curve structural scoliosis, right—cervico-dorsal, left—dorso lumbar (Figure 76A) In addition there is an extremely sharp lumbar forward curve (lordosis) The iliac crests seem to be of equal height and later antero-posterior radiographs reveal no significant difference in leg length Side and forward bending are well performed and without pain referral.

Supine Straight leg raising and cross leg tests are well performed bilaterally without pain referral.

Prone Changes from supine to prone position without breaks in the continuity of movement. There is slight fibrositic thickening over the base of the sacrum without extension into the lateral expansions or the gluteal crescents. No pain on direct pressure over the sciatic openings. Finger fork tests reveal intense nerve root tenderness on both sides of the vertebral spinous processes from the 5th dorsal to the 7th cervical levels. Hyperextension and rotatory leg tests are negative.

Foot and Leg Examination Sitting There is a surface coldness of the right foot and leg as compared to the left The right foot has an anterior scar five inches long starting on the dorsum of the foot and extending above the ankle. On the external surface there is a long lateral scar starting six inches above the ankle just behind the external malleolus and then turns to proceed down the lateral dorsal border of the foot. There are scattered partial and complete muscle paralyses of both legs characterized on the right by a marked weakness of the quadriceps and an almost complete absence of the anterior tibial group On this side there is additionally a hyperextension of the knee on standing (back knee) but a good post-operative stabilization of the foot on the ankle (elimination of previous "dropped foot) (Figure 76 B and C)

Standing Synchronized internal rotatory deviation of the right foot and ankle is slight. On the left internal rotatory deviation is extreme On the right there is anterior metatarsal descent and a confluent plantar callous over the heads of the 2nd 3rd, and 4th metatarsi.

Radiographic Examination Antero-posterior radiograph (standing) of the cervical thoracic and lumbar spines reveal an extreme structural (S-curve) scoliosis (Figure 77A) After relief of neuralgias from fixed postural shoe correction lateral pelvic radiographs (standing against the vertical wire) were made with the following results. Lateral view (1) barefoot—lumbosacral angle 65 (Figure 77B) lateral view (2) standing in the corrected shoes—lumbosacral angle 50 (Figure 77C)

Diagnosis Extreme postural imbalance Multiple severe post poliomyelitic deformities affecting both lower extremities and structural scoliosis. Generalized spinal cord tension—multiple peripheral nerve root tension neuralgias.

Treatment Patient was given fixed postural shoe correction which was quite different on the two sides as indicated by the individual findings of foot and leg ex

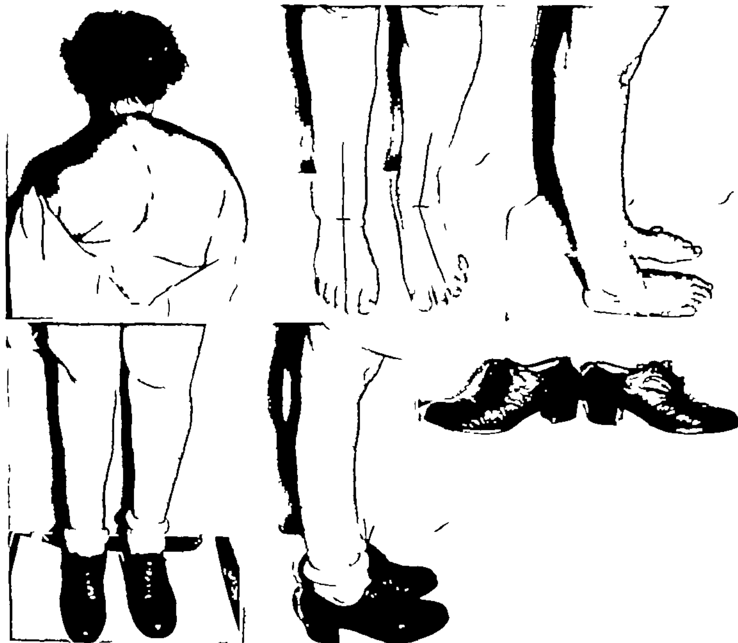
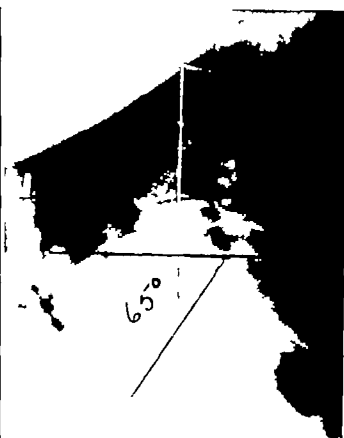


Figure 76. Case No 10—Miss M.P Multiple Postural Neuralgias as a Late Complication of Severe Poliomyelitic Deformities. A (*Upper left*) Extreme post poliomyelitic structural scoliosis (S-curve) B (*Upper center*) Antero-posterior view of feet and legs—marked differences on the two sides—right, slight—left, extreme internal rotation. C (*Upper right*) Lateral view of feet and legs—extreme differentials. D (*Lower left*) Antero-posterior view in corrected shoes—marked improvement in weight bearing lines. E (*Lower center*) Lateral view of improved posture. F (*Lower right*) Lateral view of shoes—difference in wedgings—placement of extra eyelets for snug ankle fit.

aminations. A very slight degree of correction was found to be sufficient for the weaker right leg On this side, because of muscle weakness there was a tendency to over-correction with even slight raises necessitating an outside wedging of the sole of the shoe. On the left shoe considerably more correction was required both inside and outside even to an inside wedging of the sole of the shoe. To insure snug fit both shoes were supplemented by tongue pads extra eyelets and longer laces (Figure 76 D E and F) The patient made a surprisingly rapid recovery being substantially relieved of her chief complaints, movable upper root neuralgias and fatigue, in about two months. She has been seen at frequent intervals for almost five years and it has been found that symptoms recur with every slight sag from wear in the corrected shoes

Comment The substantial relief secured in this case is particularly significant as it illustrates that generalized spinal cord tension and accompanying peripheral root tension neuralgias can be released by fixed postural shoe correction in spite of multiple deformities of the most extreme nature In fact, scoliosis of every type that develops during the growth





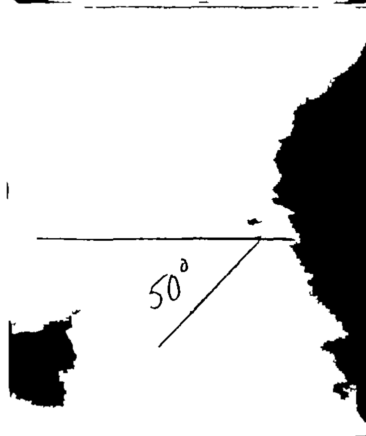


Figure 77 A (*Upper left*) Antero-posterior radiograph—maximal post-poliomyelitic structural scoliosis. B (*Upper right*) Lateral pelvic radiograph (standing barefoot)—65° lumbo-sacral angle. C (*Lower left*) Lateral pelvic radiograph (standing in corrected shoes)—marked shift to 50° lumbo-sacral angle.

period there is a marked accommodation of the spinal cord and roots to the structural changes in the container—the spinal canal of the vertebral column This opinion has been confirmed many times by similar results of treatment in other cases having deformities of lesser severity Interestingly enough, the relief of neuralgias *occurring as a late sequel to* poliomyelitic deformities is usually accomplished promptly as there seems to be little tendency to the secondary inflammatory changes that delay recovery *in other types of cases* The 15 *shift in the com* parative lumbosacral angles demonstrated in the lateral pelvic radiographs (Figure 77 B and C) represents the maximum difference found to date, having been equaled but not surpassed This wheel like movement of the pelvis—crest backward and base forward—quite understandably releases ten sion throughout the entire central nervous system

Case No. 11 Mrs. MLS *Age 44 7/21/53*

Chief Complaint Severe traumata—multiple fractures —abdominal injuries Multiple neuralgias Duration 7 years Case referred by Dr Phillip L. Rossman, in ternist, Los Angeles, Calif

Present History Following multiple injuries suffered 3/9/47 patient has had intense chronic low back pain. Of late these pains are not relieved on lying down and frequently awaken her during the night. Fatigue has become progressively severe and of such *intensity that* she cannot walk for more than a block without resting In the last month she has noted swelling of the ankles and a pain in the "ball" of the right foot The multiple injuries suffered on above date were caused by the rear wheels of an automobile passing over her pelvis just above the hip joint. A transcript made from the original hospital records (Mt Auburn Hospital, Cambridge Mass.) reports the following 3/9/47 a comminuted fracture *of the left innominate with some displacements* of distal fragments. On 3/15/47 she began to experi ence pain radiating to the shoulder blades associated with coffee ground vomitus. Operation performed 3/27/47 was reported as an exploration with cholecystostomy An acutely inflamed gall bladder was found and drained. At the time of operation there was noted extensive retroperitoneal hemorrhage and considerable edema. Wounds were closed and patient was given repeated blood transfusions On 3/31/47 there was noted swell ing of left ankle Diagnosis at time of discharge Acute traumatic cholecystitis-hemiperitoneum and recent trau matic tear of the right renocolic ligament—traumatic edema transverse colon and posterior peritoneum—recent fracture crest ilium Following discharge from hospital patient was completely bedfast for six months and has *had a high degree of partial disability* ever since.

Past History Before the above injuries patient gives no history of serious illness or operation except for a hysterectomy in 1945

General Examination Reveals middle-aged female well developed walks slowly and is in obvious pain.

Spinal Examination Standing Left total C-curve—right iliac crest slightly higher than the left. Forward bending—relatively good retention of lumbosacral bend and touches floor with extended fingers without pain referral Side bending well performed bilaterally but movement to the left causes a right contra lateral low back twinge (Figure 78A)

Supine Straight leg raising—*bilaterally*—*well* per formed to 90 angle without blockage of movement. Crossed leg test—bilaterally—(heel to knee)—negative. No significant swelling or limitation of movements of hip ankle or knee joints

Prone Considerable fibrositic thickening over base of the sacrum which extends into the lateral expansions but not into the gluteal crescents. No pain on pressure over the sciatic openings. Lumbar muscles are well re laxed Hyperextension leg tests reveal a lumbosacral bend, and this movement does not cause increased lumbar muscle spasm. Finger fork tests—bilaterally—tender over 5th and 4th lumbar roots with a decrease at the 3rd There is definite but slighter tenderness to direct pressure of all of the nerve roots below the 6th thoracic level No central fibrositic thickening above this level at any point

Neurological Examination Reflexes—knee and heel jerks active and equal. No ankle clonus

Foot and Leg Examination Standing Stands with feet outtoed 10 on both sides No significant foot (shoe) deformities Retention of long arch symmetry Bimanual rotatory tests reveal a slightly more than mod erate inward roll on the left, with the inward roll on the right being slightly less There are small bulges be low both external malleoli Delayed blanching time on *the dorsal surface of both feet is markedly* lessened by outward rotation of the feet and legs (Figure 78 B and C)

Sitting Bilaterally—flexible fore feet, no significant plantar callouses dorsiflexion reveals both heel cords are 10 short of the right angle

Radiographic Examination The antero-posterior pel vic radiograph in the standing position reveals the left leg to be ¼ inch shorter than the right at the acetabular

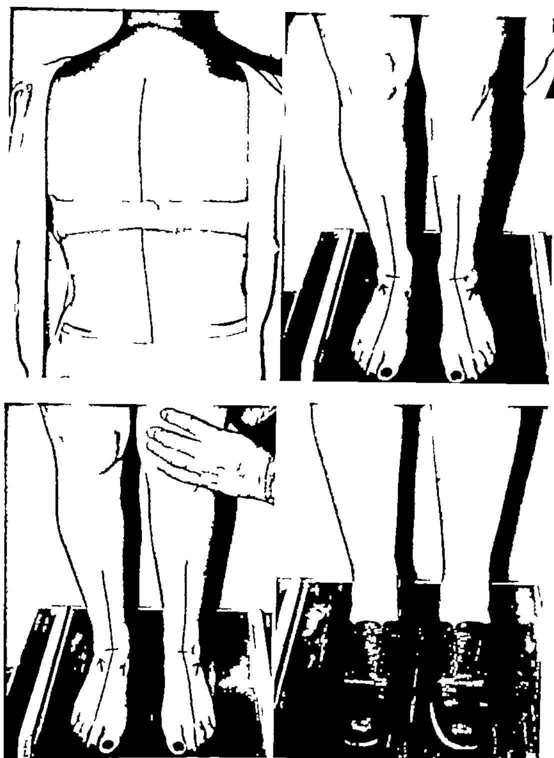


Figure 78. Case No. 11—Mrs. M.S. Multiple postural Neuralgias complicating Severe Injuries. A (*Upper left*) Slight total functional scoliosis (C-curve) from a difference of leg lengths. B (*Upper right*) Antero-posterior view of feet and legs—the internal deviation of weight bearing lines and external malleolar bulge accompanying synchronized internal rotation. C (*Lower left*) Antero-posterior view—effect of Bimanual Rotation—elimination of internal deviation of weight bearing—the disappearance of the malleolar bulge. D (*Lower right*) Antero-posterior view—same effect continuously maintained by complete fixed postural shoe corrections.



Figure 79 Antero-posterior pelvic radiograph (standing)—left leg ¼ inch short at acetabular levels—⅜ inch short at level of iliac crests Major displacement accompanying severe comminuted fractures of the ilium.

levels, and ⅜ inch shorter at the level of the iliac crests (Figure 79) The pelvic fractures and separation of fragments remain as originally described

Diagnosis Postural imbalance—generalized spinal cord tension—multiple root tension neuralgias Multiple traumata of major severity—comminuted fractures of pelvis and multiple internal injuries

Treatment Patient was given gradually increased fixed postural shoe correction based on the findings found by physical examination. Adjuvant therapy consisted of inductothermy and massage applied to the lumbar area. Since there was considerable temporary aggravation of symptoms lasting from a week to ten days with each upward corrective change, the final prescription was not attained for about six weeks (Figure 78D) Adjuvant therapy consisting of three interrupted courses of cortisone and assistant medication Substantial relief of the multiple neuralgias followed a slow fade type of reaction but at the end of two months she was almost completely pain free She is now actively engaged as a realtor a type of work that requires long periods of standing and walking.

Comment This case was selected from a large group of patients having intense neuralgias of varied types that followed initial trauma. The nature of injuries vary from those of great severity as in this case, to others in which the injury was of minor character —such as simple sprained ankles or fractures of leg bones without displacement. Many of these patients give no history of significant neuralgias prior to the onset of trauma. All too frequently in a great number of cases the almost universal latent spinal cord tension is increased by the injury Then the postural imbalance that has been aggravated by trauma maintains neuralgic symptoms long after the original injuries have healed. This is an exceedingly large group and one that is quite regularly relieved of neuralgias and associated symptoms by the fixed postural shoe corrections that reverse serial distortion.

PART VI

SUMMARY

CHAPTER FIFTEEN

Summary

ALL SHOULD agree that the opening statement of this text has been fulfilled There is much conflict in the present methods for the diagnosis and treatment of postural imbalance, and this presentation does differ materially from current majority opinion Certain portions may be so divergent as to severely strain credulity Confirmed skeptics should remember that *every variant scientific theory must successfully withstand the tests of time and experience*

In the past, the correction of foot posture has been considered solely as a means for the relief of localized foot and ankle pains The precedent extensive evidence indicates that this different approach gives to the correction of foot posture an infinitely wider application It now becomes the lever by which a change of foot position accomplishes a simultaneous shift in body posture. It must again be emphasized that in the great majority of cases the foot, the primary cause of serial distortion is a silent factor in that it may not in itself be painful Quite as important is the fact that symptoms may not arise from a definite fault in posture Many patients having excellent physiques by the most exacting standards, have a complete set of symptoms whereas others with multiple defects of considerable severity may be completely symptom free

In the course of clinical discussion the statement has been made with tongue in cheek that this investigation was based on two major discoveries viz., one, that *the foot is attached to the leg* and the other that *the spinal cord is a continuous structure* This of course is persuasive argument reduced to absurdity However many times a second look at the obvious has revealed facts of considerable clinical significance.

The first of these calls attention to the simple connection of the foot and leg and is a distinct over simplification The following analogy has been found to be more pertinent to the understanding of this specific phase of the postural problem It has been amply demonstrated that internal rotation of the foot causes an exactly corresponding shift at the ankle, knee and hip with demonstrable changes at the lumbosacral level Resultant inequality of weight to joint surfaces may be compared to uneven wear on an automobile tire that can only be terminated by correction of wheel alignment on the axle Without this preliminary change attempts at tire repair are a waste of effort

The second portion concerning the spinal cord as a unit emphasizes a general failure to recognize this simple fact but actually conceals a much greater error The spinal cord is only a segment of a complete unitary structure that comprises the brain, spinal cord peripheral nerves and the sympathetic and parasympathetic systems A mechanical lesion or even tension at any number of critical points can conceivably affect the entire inter dependent system to disturb the fine balance between stimulation and inhibition so essential to normal function

In addition to the affections that have been described as amenable to postural correction, there are indications that the scope of this problem may be considerably enlarged to include other conditions caused, or aggravated by static factors It is hoped that this different approach will aid in the solution of the diagnostic and therapeutic problems that still surround many common symptoms arising from or aggravated by postural imbalance

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This Book

THE POSTURAL COMPLEX

By LAURENCE JONES B.S., M D

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